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The Design of Hand-Operated Blow Molds

A Practical Glass Man Discusses Various Types

By Roy E. Swain[1]

BLOW molds are usually divided into two classes, paste molds and iron molds. Between the strictly paste molds and the strictly iron molds are some molds in the nature of a compromise or in some cases in the nature of a combination.

Iron Molds

The strictly iron molds are made in a number of styles and may be classed according to some characteristic peculiar to themselves.

In Fig. 1 is shown the two-part mold designed for an article whose shape is such that the use of a bottom plate that forms part of the article would be objectionable. This mold is used only where the seam around the bottom plate would be a serious objection. It is slower to work, as the article is usually removed from the mold while still on the pipe. This is done in order to steady the ware and prevent bruising or breaking while the mold is being opened. In smaller articles, where leaving the glass on the pipe too greatly delays the shop, a sectional top may be provided above the article proper. By opening this top, enough of the ware

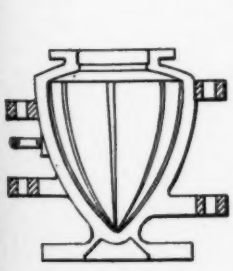

FIG. 1

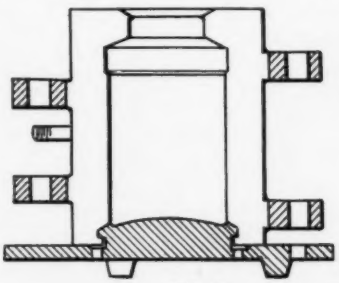

FIG. 2

is exposed to permit the mold boy to grasp the article and steady it while opening the mold proper.

The next mold in point of simplicity is shown in Fig. 2. It is perhaps used in greater numbers than all the other types combined. This mold is easy to operate and keep in condition. Where the article to be blown is plain, the large open end of the mold makes cleaning and polishing easy, by means of a lathe.

In case the article is deeply figured, either of the molds shown in Fig. 1 or Fig. 2 may be built three or four-part. The plan views of these molds are shown in Fig. 3. Unless the article has an irregular shape the mold sections are all cast from the same pattern.

The mold designer is constantly trying to improve the appearance of the product of his molds. Among the most noticable defects of iron mold ware are seams formed at the joining lines of the different sections or parts of the mold. Bottle blowers used to have what was known as a "shovey up" mold for making seamless display bottles.

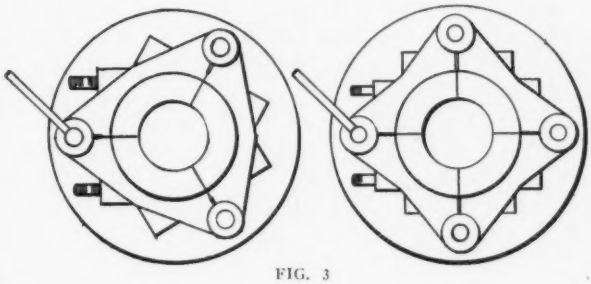

FIG. 3

This mold consisted of a slightly tapered sleeve resting on a base which housed the valve and its operating mechanism. Upon the upper end of the sleeve was mounted a sectional top that formed the shoulder and neck of the bottle. In this mold a bottle was made having no vertical seam. When arranged for display, bottles of this type have a much neater and more uniform appearance than bottles made in sectional molds. Without the valve this mold is known as a block mold and has found considerable use. In some instances where competition has been great it has displaced the paste mold. It is illustrated in Fig. 4. Fig. 4 also shows the sectional top for use either with the solid bottom or sectional bottom molds. The use of the sectional top lightens the blower's work by permitting him to form the body of the

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article in full view. He is thus able to manipulate the pipe to feed glass into the more remote sections of the article and prevent these sections blowing lighter than the remainder of the article.

There are many articles, such as oil cups that may be made two or more in a moldfull to increase production and cut down the percentage of waste glass. Occasionally multiple

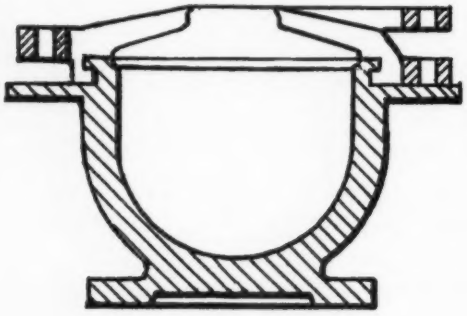

FIG. 4

molds develop defects in the ware that make the value of their use questionable. In Fig. 5 is illustrated a double shade or reflector mold of the separate top variety. If these articles are very shallow as shown in the sketch it may be quite impossible to lay the glass fully over the lower mold before closing the upper mold. It is therefore necessary to hold the glass for a few seconds while the mold is being closed. The glass in contact with the mold gets a slight set that creates an optic ring in the article which would be very objectionable in a silvered reflector. This lower mold also catches dirt, dust, etc., and for other reasons often produces an inferior article.

The use of sectional tops is not confined to iron molds as they possess the same advantages when used in connection with paste molds.

In many instances the glass article desired does not resemble the product of any standard mold but may be made in one by considering a certain portion of the "stick" as waste glass to be removed after annealing. The glass letters used upon plate glass windows for advertising purposes are often made in this manner. Quite a number of these letters are chipped in an iron mold and about each letter is chipped a "bust-off" by means of which the letter may be separated from the remainder of the stick in which it is blown. This thin glass surrounding the letter is filed or chipped off and the rough edge ground square. The principle of the "bust-off" is shown in Fig. 6 in which is shown a section of a lantern globe mold. The glass going back into sections A is blown quite thin and is easily broken. The "cut-off" indicated at B serves to keep the hotter inner glass from being pulled into the offset. It also acts as a finishing line and provides the article with a smooth rounded edge that is much less liable to damage than the rough angular edge resulting from grinding an unprotected article.

In 1872 Frederick A. Weis was granted a patent on a method of constructing molds. This mold consists of a pair of shells and a bottom-plate into which the forming parts of the mold are fitted. In this way the forming parts of the mold are comparatively simple and light. A single housing is made to serve a series of molds within a limited range of sizes and thus the original cost of a series of molds is reduced and the storage problem simplified. This type mold has never appealed very strongly to the designer of hand-operated molds but the greater part of the machine molds are now designed to utilize these advantages.

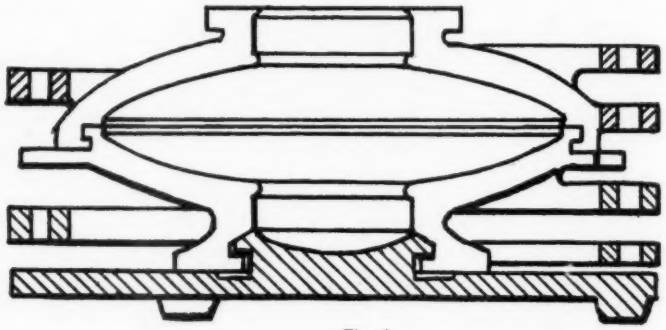

Fig. 5

Occasionally iron mold articles such as lamps, display-jars, etc., are made with a pressed foot. The blow mold is provided with a recess into which the pressed foot is placed immediately after it is removed from the press mold. The bowl is then blown, the two pieces of glass fusing to form a single article.

In designing an iron mold the designer has the problem of temperature control to bear in mind. Molds intended for American system work should be heavier in proportion to the size of the article than molds made for German system work. Figured articles also require heavier molds than plain articles. This may be explained by pointing out that the

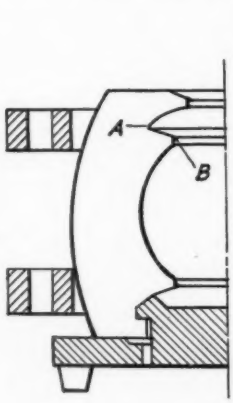

FIG. 6

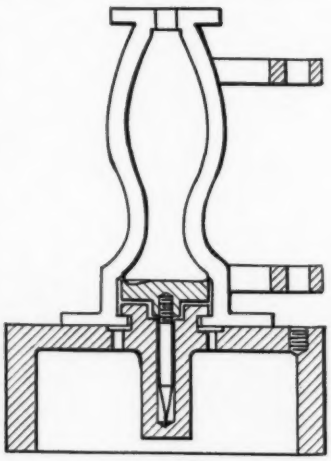

FIG. 7

molds must reduce the glass to a solid state so that the article will retain its shape after being removed from the mold. In the case of the American system the glass is worked at a higher temperature and a heavier mold is required to absorb this extra heat. In the case of the figured mold the increased surface makes possible a quicker transfer of the heat from the glass to the mold. Unless the mold is heavy enough to quickly absorb a good portion of the

heat from the figured portion of the mold surface, the small projections will become burned, causing them to scale and crack.

Combination and Compromise Molds

In Fig. 7 is illustrated a lamp base mold that is a combination of iron mold and paste mold. The body of the article is made paste mold while the bottom is made iron mold in order that the lugs may be provided to make clearance for the wiring. A hole is drilled in the bottom to admit the wiring through the bowl to the lamp socket. The upper part of the mold should be water-jacketed or

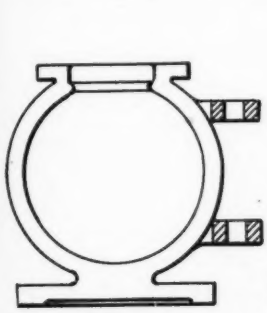

FIG. 8A

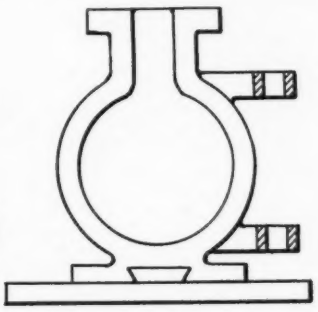

FIG. 8B

smoked as the necessity of keeping the bottom plug hot makes sprinkling this upper section very difficult. Other combination molds have been used to produce articles having screw threads or lugs yet requiring seamless highly polished bodies.

Before taking up the strictly paste mold, mention should be made of the twister and smoked molds. These molds are made at about the same weight as iron molds and the working surfaces lubricated with charcoal and resin, or flour and resin; or in the cylindrical-shaped articles a shaving may be placed in a slit in the mold. The smoke from this shaving serves to lubricate the mold. The molds must be worked hot and while a little more time may be required to set the glass than is required in paste mold work, the exceptionally bright surface finish of the ware may often outweigh the production handicap.

Paste Molds

Paste molds are quite simple in design and with very few exception may be classed as two-part molds. By two-part mold, it is understood that the mold is divided in halves. In the case of ball globes and similar articles the mold may consist of but two major parts, although for the sake of alignment they are usually provided with a bottom. These constructions are shown in Fig. 8a and 8b. As paste mold ware is always removed from the mold by means of the pipe, the use of the bottom plate as a forming member is not as important as in iron mold, but articles having a concave bottom require the use of a separate bottom plate (as shown in Fig. 9) to permit the release of the article.

Paste molds are also made with block bottoms as shown in Fig. 4. Special venting is required to provide water drainage. This problem of drainage has discouraged the use of this mold in many instances. The sectional top as shown in Fig. 4 is in some cases replaced by using what is sometimes called the cellar door top. These tops, are more difficult to align and are less satisfactory in the blowing room as they have a tendency to blow open. In Fig. 10 the layout of this type mold is shown. The front view is given to show the locking device. This top is not recommended for general use but by means of this mold an article having an undercut top may be made.

The department of paste molds is comparatively free

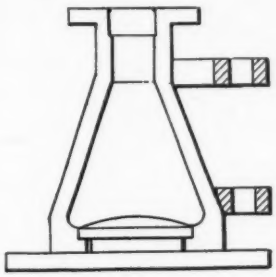

FIG. 9

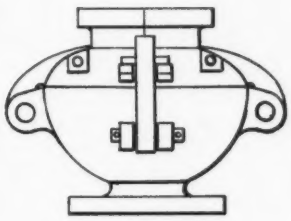

FIG. 10

from freak designs but occasionally it becomes necessary to design something a little out of the ordinary. In Fig. 11 is shown a section of a mold for producing "ring neck" ware. Articles of this type are usually made by use of a double shop, one shop blowing the article and the other laying on the ring to strengthen the finish and provide the flange. In this mold the solid flange is formed by collapsing the flange section of the mold. By this method the article is made of one piece of glass and the shop costs reduced.

Many devices have been used to eliminate the necessity of using a mold boy. These are especially popular in fac-

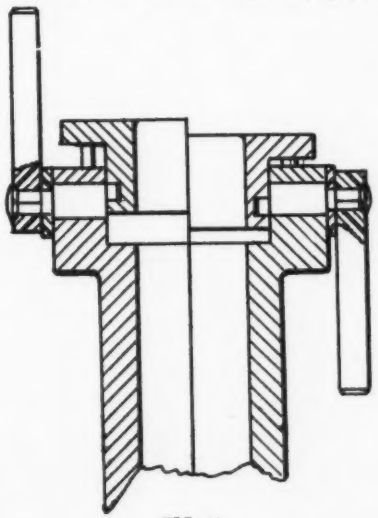

FIG. 11

tories featuring paste mold ware as the blower always removes the ware from the mold on the pipe and there is no need for a taking-out boy. Molds for use on such a device are usually equipped with standardized bottoms, hinges and lugs for the opening and closing devices. Only the more simple designs are adapted to dummy use. These molds are a step in the direction of semi-automatic and automatic machine mold design.

General Details

There are many details of mold construction that do not bear particularly on any one style of mold but help to make the mold workable and more satisfactory. Among these are hinges, locking devices, air vents, and dirt grooves and vents. Hinges are usually made quite heavy and provided with a tapered hinge pin that fits tight in the inside lugs and has a running fit in the outside lugs. This prevents the hinge becoming tight and provides the longest possible bearing surface. The forward hinges on a four-part mold are provided with lugs to limit the movement of the forward sections. By this means as soon as the forward sections of the molds are clear of the article, any further movement will cause the rear sections to open.

Iron molds should be locked tight and to do this at all temperatures an adjustable locking device is required. The split eccentric pin is widely used for this purpose. The taper pin answers the same purpose and is much less expensive although not as convenient in the blowing room, as it must be removed from the mold before the mold can be opened.

Hooks are even more convenient that the split eccentric but not always reliable and seldom used except on small molds where speedy operation is required.

Some paste molds may be worked with no other venting than the joints, but the working quality of the average paste mold will be greatly improved by well placed vents. Especially should molds be vented at beads and sharp inside corners. These vents may be comparatively large as the glass will easily pass over them. Venting iron molds is not so simple, especially those for use in American system work. A small projection is formed on the glass at this point and to keep these projections as small as possible very small drills are used. In most cases these vent marks may be hidden in the design of the article as the vents are usually used to permit the escape of air trapped in lettering or elaborations cut in the mold. A pocket is usually provided near the inside surface of the mold into which these vents are drilled. By this means a tedious and painstaking operation is lightened. All iron mold bottom plates should be provided with a groove about the centering plug to receive the dirt that is being constantly swept toward the center by the closing of the mold sections. This groove should be provided with large vents to permit the dirt to fall through to the floor. As the greater part of the dirt accumulates at the joints these vents give better service when placed directly beneath the joints. Without these grooves and vents a small chip of glass unnoticed by the blower will often hold the mold sections apart increasing the prominence of the seam and causing damage to the mold.

Courtesy C. H. Vivian in *Compressed Air Magazine.*

AN ENGRAVING ON TAPESTRY GLASS PRODUCED BY SAND-BLASTING. THE 3-TONE EFFECT IS OBTAINED BY VARYING THE DEPTH OF THE CUT, THE MAXIMUM DEPTH BEING ¼ INCH.

The Physical Properties of the Glasses and Their Relation to the Composition*

The Mechanical Properties of the Glasses

By G. Gehlhoff and M. Thomas

THE work of Schott, on the physical properties of glass, which will always remain unique in the annals of glass science, is available to the English speaking nation in English translation. The work of Turner and his associates at Sheffield University is ours through its publication in the *Journal of the Society of Glass Technology*. Valuable additions to the knowledge of the physical properties of glass have been made in Germany, during the past few years. It is believed that many of our readers will welcome the opportunity to study these results in translation.

DATA on the mechanical properties of glasses are valuable in many ways both to the glassmaker and to the user. For glass as a building material (glass roofs, window panes) one is interested essentially in the strength properties, especially in the transverse strength and impact strength. On grinding glass, grinding ordinary industrial apparatus and crystal glass, as well as grinding and polishing optical glasses, the hardness is of great importance. But most are interested in the mechanical properties, especially the tensile strength and the modulus of elasticity, because these properties are of very essential importance in the thermal resistance of the glasses. According to the formula given by Winkelmann and Schott the coefficient of thermal resistance F is calculated as:

$$F = \frac{P}{\alpha E}\sqrt{\frac{K}{s \cdot c}}$$

in which F is the coefficient of thermal resistance, P the tensile strength, α the coefficient of expansion, K the heat conductivity, s the specific gravity and c the specific heat. As we see, E and P are used directly, while the thermal properties (except α) are in the root sign of the formula.

The coefficient of thermal resistance is particularly important in working glass by machines or by hand with a blast lamp, because according to it one regulates the proper rate of working and the rate at which the glass can be heated or cooled; the importance of the thermal resistance in apparatus glasses, incandescent gas light cylinders, water level glasses, industrial glass, etc., is sufficiently well known and need not be discussed further.

The investigations to be communicated below relate to the density, tensile, transverse, compressive and impact strengths, to scratch hardness and modulus of elasticity, and the effect of different glass formers on these properties of the glasses. As experimental material there were used glasses of the same composition as we had already used in previous work [1,2] on the determination of the relation between the annealing temperature, the electric conductivity of glasses and their composition. As the glasses melted for that purpose in amounts of about 100 g. were no longer sufficient, the glasses were made again in amounts of about 30 kg. Unfortunately in a number of cases it was not possible to carry the variation of glass-forming oxides as far as in the earlier investigations; although amounts up to 100 g. can easily be made in labortory furnaces in which temperatures up to 1600° can be reached, with the larger melts required here the temperature was restricted by the design of the furnace and the type of the pot material. Difficultly fusible oxides such as Al_2O_3 and MgO could therefore be used only within moderate limits. Further, with glasses of extreme composition it was often impossible to make rather large pieces of glass free from streaks and devitrification phenomena. As an example, glasses with high PbO content were difficult to make in plates free from streaks, and glasses with high CaO could not be made free from crystals.

In order to test the mechanical properties, rods as well as plates were made from the melts. Rods and plates for the investigation were used in the same form as received from the glassmaker. It is a well-known fact that glass as it is obtained after shaping by blowing, drawing or rolling, is not a homogeneous material throughout. Just like cast metal, it is covered with a thin layer, the so-called fire-gloss, whose physical properties differ considerably from those of a free fracture surface. This fire-gloss is a surface layer that has been hardened by chilling during the working process. Ordinary glass is also more or less strained according to the method of heat treatment. From the theoretical viewpoint it would seem proper to make the experimental glasses as homogeneous as possible by careful cooling and removal of the surface layer (by grinding or etching). But as in actual practice aside from the optical industry, one deals ordinarily with a material that is not particularly homogeneous but which generally has a fire-gloss, and as especially, strength properties are of importance only for ordinary industrial glasses, while they hardly even come into consideration for optical glasses, it seemed to us to be desirable to study the glasses as they come from the normal manufacturing process; accordingly the bars that were used were not annealed, while the plates received the normal flattening furnace annealing of flat glass. Only in individual cases where this fundamental idea could not be carried out, did we deviate from it. In general the differences between annealed and unannealed glasses are very slight as regards the mechanical properties.

Density

The relation between the magnitude of the density of

* Communication from the Technical Glass Laboratory of the Osram Company, Weisswasser, Germany. Zeitschrift für technische Physik, v. 7, p. 105-26. Translated for THE GLASS INDUSTRY.

[1] Gehlhoff & Thomas, Schnelkühlung von Glas. Ztsch. f. techn. Physik, 6, (1925) 333.

[2] Gehlhoff and Thomas, Die physikalischen Eigenschaften der Gläser in Abhängigkeit von der Zusammensetzung. I. Uber das elektrische Leitvermogen, Ztscher, f. techn. Physik, 6. (1925) 544.

glasses and their composition has been the subject of many investigations. Winkelmann and Schott[3] determined the density of numerous glasses and tried to find the relation between the density and the composition in the method always used by them, by calculating coefficients for the individual oxides with the assumption of additivity. The agreement between calculation and observation is generally satisfactory. Many other investigators[4], who also determined the density of their glasses when making other investigations, found deviations from this additive property. English and Turner[5], particularly, showed that in glasses with increasing boric acid content (replacing SiO_2 by B_2O_3 retaining the alkali constant) the density increases to a certain percentage of boric acid and then decreases. The position of the maximum here depends on the quantity and kind of the other components.

The density measurements on our experimental glasses, which are to be described in the following, show something new as compared with the measurements of Peddle as well

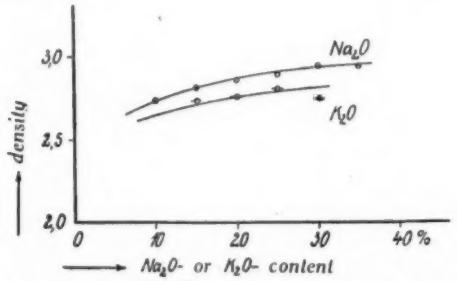

FIG. 1. DENSITY ON REPLACING SiO_2 BY Na_2O OR K_2O.

as those of English and Turner, only in so far as the glasses treated here vary in per cent by weight, while the glasses of the investigators mentioned generally varied according to mols. The density measurement was done by weighing in air and water. The measurements refer to strained glass. As is known from numerous experiments, the effect of the strain on the density is noticeable; on removing the strain, our test rods became denser, and this increase in density was about two units in the second decimal place[6]. Illustrations 1 to 5 show how the density varies when one partially replaces the SiO_2, which is in all ordinary glasses by the other glass-forming compounds: Na_2O, K_2O, MgO, CaO, ZnO, BaO, PbO, B_2O_3, Al_2O_3 and Fe_2O_3. In order to understand the illustrations better, more exact numerical data are given in table 1. The data are taken from the compensated curves and show by what amount the density of a glass

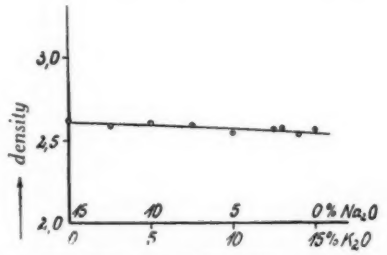

FIG. 2. DENSITY ON REPLACING K_2O BY Na_2O.

changes when 1 per cent SiO_2 is replaced by 1 per cent of another glass-forming material within a certain percentage range. As the illustrations show, within the limits given by the measurements, it is additive only with the following oxides: ZnO, BaO, Al_2O_3 Fe_2O_3. Therefore we see, that the calculation of the density from the composition is not permissible, or at most possible only within certain narrow limits.

The characteristic action of the boric acid glasses is shown very well here as by English and Turner. In a series of mixed alkali glasses there is no characteristic point as regards the density such as is found with most of the physical properties of these glasses (Fig. 2). In addition to the series given here, this fact was confirmed by measuring many similar test series in which potash was replaced by soda.

[3]Summary: Hovestadt, Jenaer Glas, Jena 1900, p. 149ff.

[4]Peddle, the development of various types of glass. Jour. Soc. Glass Techn. 4 (1920). For numerous data on glass consult J. Soc. Glass Techn. Vols. 3-8 incl.

[5]English and Turner, The physical proportions of boric oxide-containing glasses and their bearing on the general problem of the constitution of glass. Jour. Soc. Glass Techn. 7 (1923) 135.

[6]For further details see: Tool and Hill, on the constitution and density of glass. Journ. Soc. of Glass Techn, 9 (1925) 185.

TABLE 1

	0—5%	5—10%	10—15%	15—20%	20—25%	25—30%	30—40%	40—50%	50—60%
Na_2O	—	—	+0,017	+0,010	+0,008	+0,006	—	—	—
K_2O	—	—	—	+0,005	+0,003	—	—	—	—
MgO	+0,012	+0,012	+0,006	0	—	—	—	—	—
CaO	+0,018	+0,016	+0,014	+0,012	+0,009	+0,007	—	—	—
ZnO	+0,021	+0,021	+0,021	+0,021	+0,021	+0,021	—	—	—
BaO	+0,024	+0,024	+0,024	+0,024	+0,024	+0,024	+0,024	—	—
PbO	+0,024	+0,024	+0,026	+0,027	+0,029	+0,032	+0,034	+0,037	—
B_2O_3	+0,018	+0,010	+0,003	0	—0,004	—0,005	—0,005	—0,006	—0,006
Al_2O_3	+0,006	+0,006	+0,006	—	—	—	—	—	—
Fe_2O_3	+0,013	+0,013	+0,013	+0,013	+0,013	+0,013	—	—	—

TABLE 2

SiO_2	65%	83%	80,2%	74,7%	71,2%	70,7%
Na_2O	14	14	16,8	16,8	16,8	16,8
K_2O	1	1	1	1	1	1
CaO	—	—	—	5,5	5,5	5,5
MgO	—	—	—	—	3,5	3,5
BaO	20	2	2	2	2	2
Al_2O_3	—	—	—	—	—	0,5
d	measured 2,76	—1,8·0,024	+2,8·0,010	+5,5·0,018	+3,5·0,012	+0,5·0,006 = 2,50

By means of the data given in table 1, it is possible to calculate approximately the density of a given glass if the density of a glass of similar composition is known. Thus in table 2, the density of the glass in the last column is calculated in steps from that in the first column.

The calculated density value of 2.50 corresponds to a measured value of 2.51. The agreement is therefore very good.

Tensile Strength

So far as we know, only the measurements of Schott and his co-workers[7] are available on the relation between the

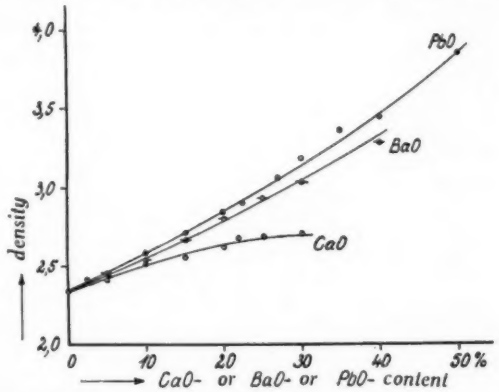

FIG. 3. DENSITY ON REPLACING SiO_2 BY CaO, BaO, OR PbO.

tensile strength of glasses and their composition. As experimental material, ground and polished glass rods of square cross section were used by them; the measurements included glasses with numerous components and very different compositions. In order to determine the effect of the individual glass-forming oxides on the tensile strength, coefficients for the oxides were calculated with the assumption of a linear relation between composition and tensile strength. The values

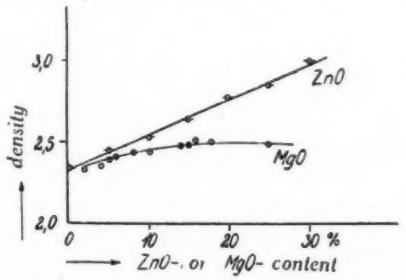

FIG. 4. DENSITY ON REPLACING SiO_2 BY ZnO OR MgO.

for CaO and MgO, according to the statement of Schott himself, are particularly unreliable on account of the comparatively low content of these oxides in the experimental glasses. Deviations from the linear relation could not be recognized in this manner. If we disregard this, the constituents arranged in the order of their effect on the tensile strength are as follows: ZnO, SiO_2, B_2O_3, BaO, Al_2O_3, PbO, Na_2O, K_2O. Further, an older investigation by Brodmann[8] shows that the tensile strength is increased considerably by removing the fire-gloss by etching. His measurements referred to very thin rods at most 1.8 mm. in diameter.

In our measurements we used rods about 5 cm. long of circular cross section about 3 to 4 mm. in diameter. As is shown in Fig. 6b, these rods were provided with cones of sealing

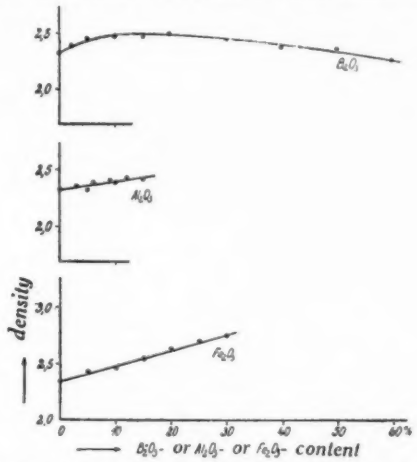

FIG. 5. DENSITY ON REPLACING SiO_2 BY B_2O_3 OR Al_2O_3 OR Fe_2O_3.

wax on both ends which while still soft were gripped in the conical openings of cross-bars (Fig. 6). This arrangement assured a safe suspension without any straining of the test rods by the grips. As can also be seen from Fig. 6a, the cross-bars as well as suspension and loading beams had hardened pans between which are placed steel balls so that the entire system could be moved easily and the individual parts could be adjusted safely in their center of gravity position. Besides, after assembling and while the sealing wax

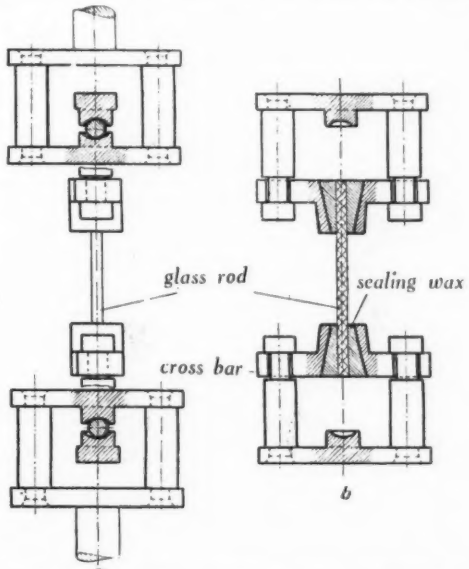

FIG. 6. GRIPPING AND SUSPENSION ARRANGEMENT FOR TENSILE BREAKING OF GLASS RODS.

was still soft the entire system was put under a slight load so that any cracking moment was removed and cracking of the rod on loading was avoided.

The rough loading was done by adding lead plates each about 10 kg. in weight, and the fine loading was done by

[7]Winkelmann & Schott, Uber die Elastizität und über die Zug-und Druckfestigkeit verschiedener neuer Gläser in ihrer Abhängigkeit von der chemischen Zusammensetzung. Ann. 51 (1894) 697.

[8]Brodmann, Einige Beobachtungen über die Festigkeit von Glasstäben. Nachrichten von der Kgl. Gesellsch d. Wissensch. zu Göttingen 1894, 44.

running quicksilver from one lead plate to the other. The rod could be released from the load at any time by means of a catch. The amount of drop was only a few millimeters.

So that the fracture in each case would actually be due to tension and not to cracking, the surface was tested by inspection. Only those measurements were accepted in which the fracture surface had the coarse, fibrous, deeply grooved appearance under the microscope that is characteristic of tension. If the fracture was caused by cracking, the surface of fracture showed a completely smooth and reflecting surface. Preliminary experiments showed that rods in the strained condition frequently did not break properly but cracked easily; for this reason the investigations were made on annealed glass.

Just as in the investigations of Winkelmann and Schott, a small part of the area showed a smooth surface even in true tensile breaks. From this point the characteristic grooves spread out like rays (Fig. 7). As we have learned from breaking tests on metals, the centre of radiation, which here is a small reflecting surface, must be regarded as the part of the cross section where breaking starts due to some defect in the material, and from which it spreads out over the entire cross section. The values for the tensile strength vary somewhat according to the size of this smooth surface. A clear relation between the values of the tensile strength and the part of the entire cross section on which the break started can be seen from Fig. 8; the measurements refer to a lead glass. The measuring of the properly broken, fibrous part and also the original cracked reflecting portion of the cross section was done under the microscope using a micrometer ocular. When the break starts at a small area in relation to the cross section, the tensile strength has a higher value than with a large initial area; the actual tensile strength

FIG. 7. FRACTURE SURFACE OF A BROKEN GLASS ROD. AT TOP: AREA WHERE TENSILE BREAK STARTED.

would correspond to the extrapolated value at 0 per cent of this area. However, as an extrapolation is always rather uncertain, we considered it better to give for the tensile strength a value that corresponds to a certain percentage value for the reflecting surface. For this reason, in the following measurements we have always given the value of the tensile strength for a 10 per cent surface at which the tensile break starts. It is not exact to refer the tensile strength merely to the actually broken part of the fracture surface, that is, to give the coarse fibrous area a value in kg./sq. mm., because at first the entire cross section of the rod doubtless comes into consideration in the strength and aids the weaker cross section that breaks first. The value for the tensile strength with 90 per cent true fracture surface, as Fig. 8 shows, can be obtained rather satisfactorily by interpolation. The values for the tensile strength of glasses obtained according to this definition show rather satisfactory agreement. An accuracy of 5 per cent could be obtained directly, which many times was not very far from the values obtained by Winkelmann and Schott. Nevertheless some experimental

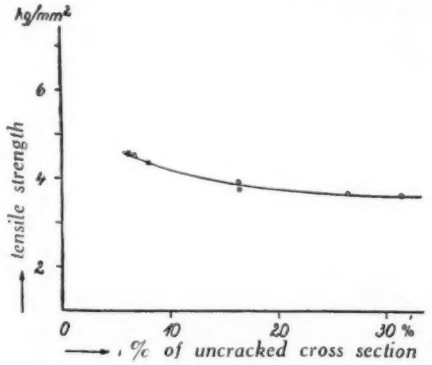

FIG. 8 TENSILE STRENGTH IN RELATION TO PER CENT OF UNCRACKED CROSS SECTION.

glasses gave somewhat greater deviations which probably must be traced back to lack of homogeneity and not very exact composition of the glass.

Each point for the tensile strength values is based on at least 5, generally more, and up to 10 measurements. As was already remarked, the tensile strength measurement was made on annealed glasses. The investigation of strained and annealed samples of a factory glass showed that strains, to the extent that they were present in our rods, had slight influence on the tensile strength. The same result was obtained for the influence of the fire-gloss which was removed by etching

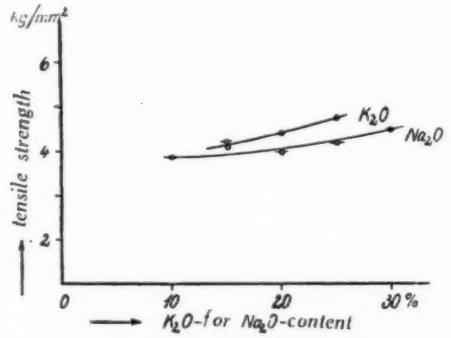

FIG. 9. TENSILE STRENGTH ON REPLACING SiO_2 BY K_2O OR Na_2O.

off a few tenths mm. The following values were obtained for this glass.

	Tensile strength
Strained rod	3.97 kg./sq. mm.
Annealed rod	4.16
Etched strained rod	4.16

This latter result which contradicts the investigation of Brodman is explained by the fact that the cross section of our rod was considerably greater than his, and accordingly the effect of the fire-gloss is not great. In addition, the cross sections of his etched samples showed no reflecting spots as compared with those that were not etched. As in his evaluation no consideration was taken of the appearance of the broken surface, the higher strength value for the etched samples can be understood from the above.

The results of the measurements which were made on our experimental glasses are explained in the following by means of the illustrations.

Monovalent Glass-Formers

As the series of experimental glasses with increasing potash or soda content show, the alkalies raise the tensile strength, and potash acts more strongly than soda (Fig. 9). If we replace one of the two alkalies by the other, for example, potash by soda, the tensile strength varies in a linear manner (Fig. 10). Consequently there is no characteristic relation between K_2O and Na_2O in which the tensile strength would reach a maximum or a minimum as is the case with other properties such as solubility, electric conductivity and annealing temperature.

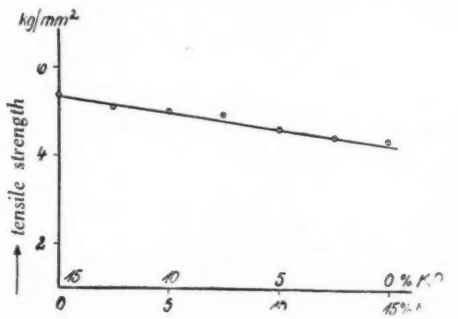

FIG. 10. TENSILE STRENGTH ON REPLACING K_2O BY Na_2O.

Divalent Glass-Formers

Of the divalent glass-formers, CaO, BaO, and PbO increase the tensile strength considerably, and, as a matter of fact, CaO is the strongest, then comes BaO, and finally PbO (Fig. 11). With CaO and BaO there is an optimum in the vicinity of 25 per cent. Unfortunately, for the reasons that have already been stated above, these curves could not be prolonged to higher percentages. It is noteworthy that BaO, CaO and PbO as regards the tensile strength are in the same order as their influence on other properties such as electric conductivity[9] and the annealing temperature[10]. MgO and ZnO have only a slight effect on the tensile strength (Fig. 12). The curve for MgO is rather uncertain because the rods broke very badly; they most generally cracked.

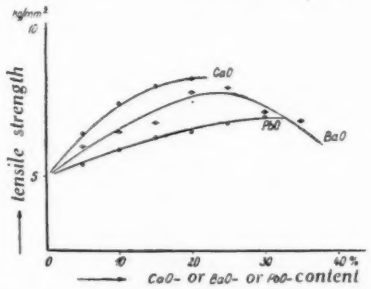

FIG. 11. TENSILE STRENGTH ON REPLACING SiO_2 BY CaO, BaO OR PbO.

Trivalent Glass-Formers

Of the trivalent glass-formers, B_2O_3 gives a very noteworthy curve. There is a maximum here for the tensile strength at about 15 per cent (Fig. 13). This optimum tensile strength exactly corresponds with the most favorable action of boric acid glasses with from 12 to 16 per cent boric acid as regards solubility as well as many other properties. With each physical or chemical property there seems to be a maximum or minimum glasses with increasing boric acid content at approximately the same percentage composition.

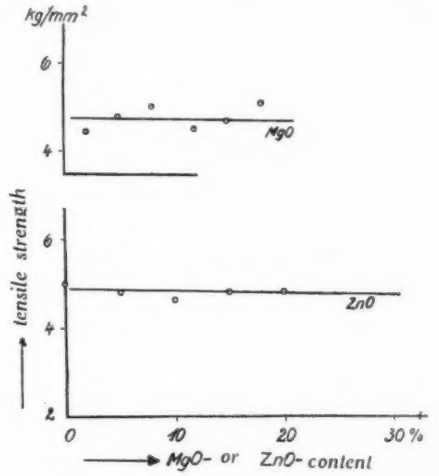

FIG. 12. TENSILE STRENGTH ON REPLACING SiO_2 BY MgO OR ZnO.

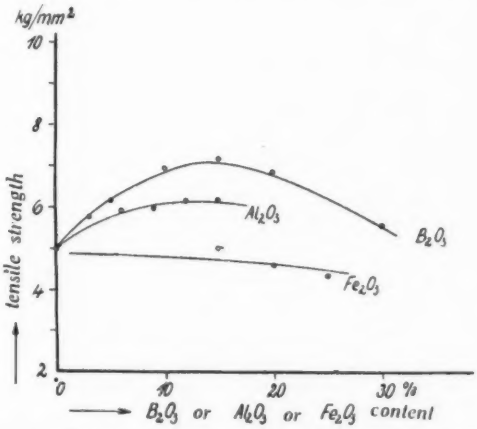

FIG. 13. TENSILE STRENGTH ON REPLACING SiO_2 BY B_2O_3, Al_2O_3 OR Fe_2O_3.

Al_2O_3 increases the tensile strength to a slight extent; Fe_2O_3 seems to have a very slight effect on the tensile strength.

In order to give numerical data in addition to these quali-

[9]Gehlhoff and Thomas, Die physikalischen Eigenschaften der Gläser in Abhängigkeit von der Zusammensetzung.

[10]Gehlhoff and Thomas, Schnelkühlung von Glas.

TABLE 3

	0—5%	5—10%	10—15%	15—20%	20—25%	25—30%	30—35%
Na_2O	—	—	+0,01	+0,02	+0,04	+0,06	
K_2O	—	—	—	+0,05	+0,07	—	
MgO		Effect very slight					
CaO	+0,28	+0,2	+0,12	+0,05	—	—	
ZnO		Effect very slight					
BaO	+0,17	+0,14	+0,12	+0.11	+0,04	—0,08	—0,14
PbO	+0,09	+0,09	+0,08	+0,06	+0,05	+0,04	
B_2O_3	+0,19	+0,13	+0,05	—0,06		—0,14	
Al_2O_3	+0,16	+0,05	+0,03	—	—	—	
Fe_2O_3		Effect very slight			—	—	

TABLE 4

SiO_2	65%	83%	80,2%	74,7%	71,2%	70,7%
Na_2O	14	14	16,8	16,8	16,8	16,8
K_2O	1	1	1	1	1	1
CaO	—	—	—	5,5	5,5	5,5
MgO	—	—	—	—	3,5	3,5
BaO	20	2	2	2	2	2
Al_2O_3	—	—	—	—	—	0,5
Tensile strength	measured 4,45	—5·0,11 —5·0,12 —5·0,14 —3·0,17	+2,8·0,02	+5,5·0,28	0	+0,5·0,16 =3,8

tative data, which makes it possible to calculate the tensile strength of glasses of given composition, we give in table 3 for the individual glass-forming oxides, the amounts by which the tensile strength changes when 1 per cent SiO_2 is replaced by 1 per cent of the oxide in question within a certain percentage range.

TABLE 5

SiO_2	65%	85%	63%
Na_2O	8	8	8
K_2O	7	7	7
PbO	—	—	22
BaO	20	—	—
Tensile strength	measured 4,75	—5·0,11 —5·0,12 —5·0,14 —3·0,17	+5·0,09 +5·0,09 +5·0,08 +5·0,06 +2·0,05 =4,1

To summarize the above, it may be stated that the oxides can be arranged in the following sequence as regards their influence on the tensile strength: CaO, B_2O_3 (only to about 15 per cent), BaO, Al_2O_3, PbO, K_2O, Na_2O, SiO_2, MgO, ZnO, Fe_2O_3. The underlined members show no differences in their action on the tensile strength. The series given by Winklemann and Schott (ZnO, SiO_2, B_2O_3, BaO, Al_2O_3, PbO, Na_2O, K_2O) is entirely different and does not express the characteristic action of the boric acid glasses.

Just as with the density we also tried to calculate the tensile strength of a given glass from a known glass of similar composition (Table 4).

The calculated value was 3.8 kg./sq.mm. and the measured value was 4.5 kg./sq.mm. The agreement is not very good, probably because as was already remarked, the value for MgO is somewhat uncertain. A far better agreement was obtained with the calculation shown in table 5.

Here the measured value was 4.1 kg./sq.mm. The agreement is, therefore, rather good.

(To Be Continued)

The Manufacture of Laminated Safety Glass

By Joseph Rossman[1]

Part IV

SINCE one piece of laminated glass requires two or more pieces of flat glass, it is evident that its adoption, not only for automobiles but also for use in ship construction, for gauge and other dial glasses, in airplanes, in bank partitions and for other safety and protective purposes means much to the sheet and plate glass industries.

(Continued from the March, 1929, Issue)

Ophthalmic Lenses

Bugbee 1,153,859. Sept. 14, 1915.

The process of forming an ophthalmic lens blank consisting in coating the two parts thereof with a suitable uniting medium whose fusing point is lower than that of the parts, such as a borate or silicate compound, which will become liquid or plastic only at a high temperature, but which at the same time will melt or fuse at a considerably lower temperature than that at which the parts to be united will become plastic, heating the parts to the fusing point of the connecting medium, continuing the heating action until the completion of the reaction of the connecting medium, placing the parts with the coated portions thereof in close engagement, and annealing the completed blank.

Alarm-Glass

Hitchcock 1,223,583. Apr. 24, 1917.

A compound alarm plate comprising two sheets of glass with an interposed transparent layer of celluloid attached

[1] Patent Examiner United States Patent Office, Washington, D. C. Chemical Engineer, Member of the District of Columbia Bar.

to the sheets and in which is embedded a signal wire extending back and forth through the layer.

Eye-Protecting Goggles

King 1,285,266. Nov. 19, 1918.

A lens comprising a glass disk and a celluloid annulus cemented between them.

Compensating Press

Bartelstone 1,334,588. Mar. 23, 1920.

This invention contemplates a plurality of resilient or elastic pressure elements so arranged and constructed that the central elements may be brought into action in advance of the outlying elements, and caused to exert the pressure which grows in intensity at a rate at least equal to that of the outlying elements, until they all are exerting substantially equal pressure. These pressure elements consist of spring jacks. These jacks are preferably arranged to bear at one end against a rigid inclosed frame consisting of two channel bars held together near their ends by tension rods which preferably are threaded at one end to receive nuts whereby the distance between the channel bars may be regulated. In order to prevent any side slip during the application of pressure, a collapsible frame is employed which consists of side members hinged together at their ends, and which are preferably composed of comparatively heavy heat conducting material, such as brass, so that the heating and cooling of the plates inclosed thereby may be exploited.

Lens

Tillyer 1,340,189. May 18, 1920.

An ophthalmic lens comprising a pair of polished glass surfaces and an intermediate cementitious film of appreciable thickness, the film consisting of an adhesive gum combined with toughener. A very satisfactory adhesive for general purposes may be formed by the use of a compound of about 96% shellac or kindred substance with about 4% carbolic acid.

Wire-Glass

Shuman 1,355,625. Oct. 12, 1920.

A fire resisting glass comprising a wire glass layer, combined with a second layer having a glass composition, and an interposed layer of a pliable material such as celluloid firmly attached to the glass layers and which is normally transparent or translucent to light but under the action of high temperature becomes darkened so as to be substantially opaque to light and athermous to radiant heat.

Apparatus for Making Reinforced Glass

Bull 1,539,239. May 26, 1925.

The invention comprehends the use of a closed vessel or vault-like receptacle adapted to contain a plurality of superposed plate units, improved pressure applying means not involving the use of steam, water or liquid within the vessel, combined presser and separating plates or frames for the plate units, in combination with means for supplying dry heat to the receptacle, means for exhausting air from the receptacle, and means for circulating air within the receptacle, the material to be treated being arranged in a stack within the receptacle in spaced relation with the walls thereof and directly subjected to temperature conditions, etc., therein.

Apparatus for Making Reinforced Glass

Bull 1,553,667. Sept. 15, 1925.

A laminated glass fabricating apparatus comprising a multiple press device having a plurality of press units each including upper and lower platen members, means for holding the platen members rigidly spaced apart in their respective planes thereby to provide an air passage between the platens.

Apparatus for Fabricating Reinforced Glass

Bull 1,575,969. Mar. 9, 1926.

It is proposed to provide a novel multiple press device including a plurality of relatively stationary press units each having its own individual pressure applying means, all of such means of all of the units, however, being subject to common and uniform control from a single point or operating station. One of the objects of a multiple press device is to provide a plurality of superposed units wherein the weight of each unit is supported independently of the other, thereby relieving the lower units from the weight of superposed units and making it possible to more accurately apply definite or known pressure to each laminated glass product being treated. The present invention has in view the use of a press device employing compressed air as the pressure medium. Not only does the use of a compressed fluid permit of more definite control for the variable application of pressure, but also permits of such an arrangement of the individual press units as will enable each unit to function more definitely and positively because the weight of superposed units does not enter as a factor into the calculation of pressure imposed on the lowermost units of the stack. Furthermore, by the use of compressed air during the initial stage of the heat period, through a sensitively operated air valve control, it is possible to control the pressure during the warming up stage so that the plasticity of the softening membrane may be taken advantage of at the opportune period to assure by this type of pressure, and its manipulations, a more dependable spreading out of the intermediate softening membrane, thus gaining a more general contact between all of the surfaces of the components entering into the material being treated.

Shock-Resisting Glass

Bull 1,632,363. June 14, 1927.

The invention involves the distinctive feature of a glass product consisting of two or more pieces or layers of glass having within their composition suitably spaced strands of wire of high tensile strength, and the individual layers being united by an interposed layer or sheet of transparent pyroxylin, nitrocellulose or equivalent welding substance. The invention contemplates a product combining the advantages of wire reinforced glass and bullet-proof scatterless glass of the type consisting of laminated layers united or welded together by a transparent binder.

Manufacture of Glass

Hope 1,644,131. Oct. 4, 1927.

Two sheets of glass are united by a viscous mass of partially polymerized di-alkyl ester of itaconic acid to a sheet of transparent cellulose acetate. Polymerization is then completed by heating the composite sheet for three days at 70° C. when an unsplinterable sheet is produced.

Apparatus for Making Laminated Glass

Bock 1,645,580. Oct. 18, 1927.

The invention embodies means for circulating liquid in a heated condition and at different pressures during successive stages and within a closed chamber within which is positioned a hermetically sealed container for a plurality of glass sheets with an interposed layer of adhesive, whereby heated liquid may be circulated for a required period of time to render plastic the adhesive layer and subsequently thereto the liquid is circulated under pressure so as to so act upon the container and the contents thereof as to effect the union of the glass sheets by the plastic interposed layer. A pressure chamber is employed within which is deposited one or a plurality of the containers composed of flexible material and provided with means for exhausting air therefrom and with means for hermetically sealing the container subsequently to the operation of placing therein a plurality of glass sheets between which is interposed a layer of material, such as celluloid, the whole being confined within the container to the substantial exclusion of air. Cooperating with the pressure chamber is a service pump and a liquid heating means whereby the liquid may be recirculated as required between and within the pressure chamber and the heating means. In addition to the heating means and the service pump, the apparatus is equipped with a high pressure pump so connected that it performs the function of circulating the liquid in a heated condition and at relatively high pressure within the pressure chamber. Means are provided for by-passing the liquid with respect to the service pump when the high pressure pump is acting, and in like manner means are provided for cutting the high pressure pump out of use when the service pump is in use.

Apparatus for Making Composite Glass

Owen 1,657,227. Jan. 24, 1928.

Heretofore, it has been the practice to assemble the set of sheets to be joined in a rubber bag or container, which is then placed in a tank and exposed to hydraulic pressure, the interior of the bag being open to the atmosphere, and the liquid which applies the pressure being heated to soften the gelatin. The object of the present apparatus is to provide a more convenient means for carrying out this procedure, so that the labor involved is less and the time required is reduced. This is accomplished by substituting for the rubber bags, pairs of rubber diaphrams between which the sets of plates to be joined are placed, and by providing for a multiple pressing and heating operation.

Method of and Apparatus for Laminating Glass Under Incremental Differential Pressures

Bartelstone, 1,667,832. May 1, 1928.

To produce a uniformly complete adhesion, it is absolutely essential that no excess fluid shall be permanently pocketed in any local areas and that no air-bubbles shall be permitted to remain between the sheets. This invention is predicated upon the discovery that all such tendencies towards "pocketing" may be very efficiently yet easily precluded by the application of a differentially graduated compression, whereby the ultimate contact grows from a more or less central spot and progressively lengthens and spreads spoke-like or branchlike; permitting the fluid to escape through flared channels which gradually shorten and narrow (until ultimately eliminated) as the cohesion extends. This invention accordingly proposes so to apply and progressively develop the sealing pressure that channels will be initially provided and progressively reduced between the adjacent faces of the sheets; these channels affording a sufficiently free egress of the fluid (together with any air bubbles) and thereby prevent any pocketing of these elements. One convenient method of carrying out this process consists in preparing and assembling the sheets of glass and the sheet, or sheets, of celluloid in the usual manner, placing the whole under slight pressure to expel the greater portion of the fluid before any substantial adhesion is effected, then increasing the pressure more rapidly at the central region of the laminae to effect substantially complete expulsion of the fluid at that region, thereby to effect complete cohesion of a small central area; then gradually to extend, in certain general directions, the area upon which the increased pressure is exerted, the area constantly being of such a contour as to provide slightly depressed channels which permit unobstructed egress of the fluid; continuing to extend the area of maximum pressure and gradually closing the channels from their innermost ends until the fluid is expelled and a perfect and uninterrupted union is effected between the laminae. This invention also proposes an apparatus capable of being used in conjunction with a power press of conventional form for effecting the lamination of glass by the improved process. This apparatus includes a platen or platens, adapted to be placed in contact with one, or both, of the outside sheets of glass before the laminae are placed in the press, the platens being formed with an undulated surface having a summit adapted to be arranged in proximity to the central region of the laminae. By the use of such a platen the pressures may be applied upon the laminae as hereinbefore described by the mere gradual closing of the power press.

Process of Uniting Vitreous Pieces

Long 1,668,853. May 8, 1928.

A process of uniting vitreous surfaces which consists in accurately fitting the surfaces to be joined, and producing thereon a smoothness produced by grinding with fine emery, applying to the surfaces while hot a concentrated heated solution of synthetic resin such as a phenol and formaldehyde condensation product, driving by heat the solvent from the surfaces, and uniting the surfaces under pressure and heat.

Laminated Glass and Process of Producing the Same

Randall 1,693,729. Dec. 4, 1928.

Resin free, bleached, pale crepe rubber is dissolved in a suitable solvent such as benzol, etc., to form a solution. The solution is applied to one side each of two sheets of glass to form a skin or film thereon.

Industrial Art at Metropolitan Museum

Exclusively American Designs Compare Favorably with Best European Work

THE industrial art of America had its most distinguished showing in the Exhibition of American Industrial Art held recently at the Metropolitan Museum of Art in New York. In one of the world's great art museums, its galleries filled with the finest work of old masters and of the craftsmen of other centuries, there had been brought together a thousand and one products of factories and workrooms over the country. Each gave choice expression to contemporary style in the United States, each had distinctive art value in the manner of today, every one was produced especially for this affair—even to the entrance doors to the gallery, the cords before the exhibits and the carpet on the floor—and all were arranged in fascinating group displays by well known architects.

THE CENTRAL GARDEN FEATURE

Designed by Armistead Fitzhugh, executed in vari-colored and turquoise glass by Frederick F. Keppler Relief Glass Company, Corning Glass Works, and A. Douglas Nash Corporation.

This is the first exhibition of the sort by a museum in which everything is American-designed and American-made. It makes quite clear the fact that our designers have no need to go abroad for their design, that quality production in American manufactures is on a par with that quantity production for which we are famed and that an art museum can do much for the constructive encouragement of art in industry and in daily life.

The groups shown include a backyard garden, a study in a country home, a show window and sales alcove, a conservatory, a woman's bedroom, a man's den, a child's nursery and bedroom, a dining room, a bath and dressing room, an apartment house loggia, a business executive's office, a salesroom and a central garden feature. They were designed by nine architects who contributed their time, ideas and labor. Frederick Carder of the Corning Glass Works and Louis C. Tiffany, the New York designer, were on the advisory committee working with the architects.

All the designs were treated with the utmost freedom and individuality but with careful recognition of modern needs of living and working, well studied use of known materials, skillful application of newly discovered industrial products, and with a thorough Americanism throughout.

The wide range of materials utilized (glass was much in evidence) and the practical combinations of beauty with useful designs were striking. The general effect of the exhibition was satisfying and a host of details attracted instant attention because of their novelty, practicability, and their well-designed proportions.

The Central Garden Feature, illustrated here, designed by Armistead Fitzhugh, architect, was one of the most prominent of the exhibits. The designer took his inspiration from the "Amen" music in "Parsifal." This attractive garden was constructed of vari-colored glass panels giving a very beautiful effect when illuminated through the molded glass from within the structure. This glass was designed and executed by the Frederick F. Keppler Relief Glass Company, in collaboration with the Corning Glass Works. The beautiful turquoise opaque glass also used in the construction of the garden was designed by Armistead Fitzhugh and A. Douglas Nash Corporation, and was executed by the latter organization.

Glass for the show window and sales alcove was furnished by Semon Bache & Company. The decorated glass of the dressing table and shelves in the bath and dressing room and plate glass and the mirrors came from Bostock, Rhoades & Company. The windows were designed by Ely Jacques Kahn and the carved glass by Eny Art, Inc. The Steuben division of the Corning Glass Works designed and executed the glass walls in these rooms.

In the apartment house loggia the table tops were of vitrolite glass designed by Raymond M. Hood and executed by Carvart Glass Studio. The window floodlighting was done by The Frink Corporation.

In the business executive's office the plate glass was furnished by the Pittsburgh Plate Glass Company, and etched by Eny Art Inc. In the sales room the decorative glass and floodlighting was designed by Ralph T. Walker and Maurice Heaton and executed by the latter.

In the man's study the lighting arrangements were most

interesting. Two lamps hung from the ceiling, adjustable up and down at any desired height from the floor and also set in slots at the top, so that they move laterally several feet. Novel lighting effects were seen everywhere, in fact, among the most striking being the lighting of the dressing table mirror in the woman's bedroom, at either side of the glass of which are etched female figures from the back of which the mirror has been removed and the lights are behind the glass. A wall mirror is also outlined in the light.

An attractive "Fountain of Light" in the sales room showed a figure designed by Otto and Lora Webster and had mercury vapor flowing through glass tubes instead of a water spray. Here there was also a vitrolite desk. The business office had fine etched window panes and in the conservatory was glass etched by the new "carving" process of Eny Art Inc. described in a recent issue of this journal.

Leaded glass for the window in the men's study was designed by Ralph T. Walker and Len T. Howard, and executed by Howard Geisler & Rowe, Inc. Glassware in the study was designed by R. T. Walker and executed by Erskine B. Van Houten. Glass lighting fixtures and lamp designed by Urban and executed by the Eglie Company, Inc., and Black and Boyd Manufacturing Company, were used in several of the booths and also etched glass designed by Urban and executed by Peter Ander, Inc. Reflectors were furnished by The Frink Corporation, N.Y. Other lighting fixtures and lamps were from the Curtis Lighting Company, Inc. Glass curtains designed by Winold Reiss, and executed by The Shelton Looms, were used in the woman's bedroom. It also contained a standing mirror designed and executed by the Noble Studio of Metalarts, Inc. Edward F. Caldwell & Co. also supplied lighting fixtures designed by Eliel Saarinen and dining room glassware designed by the same artist and made by the Corning Glass Works was an interesting part of the exhibit.

These are but a few high spots briefly touched upon to indicate the wealth of interest there was in the exhibition. "There is nothing queer about our style of today," says Robert W. de Forest, president of the Metropolitan Museum. "It has in it the elements of practical use and good sense which must be at the bottom of all good art."

Building a Bottle Business Direct by Mail

Selling Not Only Bottles But Company Bonds

By B. C. Reber

THE success of the Three River Glass Company of Three Rivers, Texas, manufacturers of glass bottles and containers, in building up and greatly increasing their business by means of direct by mail advertising is an excellent illustration of the value of this form of sales promotion and has moreover opened up the way for the highly successful flotation of a bond issue by the company. All of the recent advertising done by this firm has been by some form of direct by mail literature, and all has proven satisfactory in getting the desired results.

The Three Rivers Glass Company is the only plant in Texas devoted to the manufacture of glass containers for soft drink, dairy, drug and miscellaneous packing industries. Until within the last year, practically all of their sales promotion effort had been through their salesmen. If a new container were developed, the trade was so informed on the next call of the representative.

Recently, however, this organization recognized the feasibility of a more consistent effort to enlarge their business. The need of a catalog that could be kept handy by the prospective buyer at all times was one of the things realized. Then it was determined to map out a sales campaign, sending out direct by mail literature each month. This was for the promotion of sales exclusively.

The catalog was designed in loose-leaf form. The pages were fastened together with standard fasteners and so arranged that new pages could be inserted as they were brought out. This not only developed an efficient and economical piece of advertising, but made it possible for the customer to keep his catalog up to date at all times. Approximately five thousand of them were mailed out at first, and new pages describing new products, changes in size or design, change in prices, and other information, have been brought out from time to time since the initial distribution.

Following the catalogs, envelope stuffers were designed for monthly distribution. These were almost entirely institutional in design, going into the history and development of the company, its ability to deliver promptly, and the equipment installed for bringing out any glass container required by the trade.

Through the efforts of the sales department, backed up by this campaign, the company has been able to acquire practically all of the business of this type in the State of Texas, and would be able to extend its activities considerably further did not prohibitive freight rates make it impossible to compete with manufacturers in other territories.

The company manufactures a large line of soda bottles of standard and special design for soft drink bottlers, a complete line of standard and special design bottles for dairies and milk plants, a complete line of jars, glasses and other containers for the packing of fruits, vegetables, meats, fish and other products.

Having tested the possibility of extending its business through the method employed in the first campaign, the Company executives decided to use the same means for placing a bond issue for $150,000 for new equipment and additions to the buildings. The catalogs that had been distributed among the customers and trade were again used to educate bankers, investment brokers and financiers in the new bond issue. It showed them what was being made by the concern, the large volume of business the plant was doing, and gave them a more explicit understanding of

Owens Bottle Takes Over Illinois Glass Company in Vast Merger

Two of the World's Largest Bottle Manufacturing Companies United in One Organization

Unexpected and startling news broke suddenly in the glass trade when at Toledo, Ohio on March 27, William H. Boshart, president of the Owens Bottle Company, announced that after negotiations extending over a considerable period, an agreement had been reached with the Illinois Glass Company for the consolidation of the business of the two concerns. The name of the new company will be Owens-Illinois Glass Company.

The deal brings together two of the large manufacturers of glass containers, with nation-wide sales organizations, plants located at strategic points in every section of the country, and an important good will throughout the trade.

WILLIAM H. BOSHART

The great merger was brought about principally through the efforts of Mr. Boshart, who became connected with the Owens Company in 1906 and had advanced through various executive offices in that company to the presidency of the concern and the direction of its activities. He has now capped the climax of his career by bringing together two hitherto strongly competitive companies after years of effort on the part of the Owens organization to accomplish that purpose. He has at last materialized into practical results the hopes and efforts of the company's preceding administrative forces.

With the consummation of the consolidation, the Owens Company will acquire substantially all of the assets of the Illinois Glass Company including the largest individual bottle plant in the world, located at Alton, Illinois, and also large modern plants at Bridgeton, New Jersey and Gas City, Indiana; and in addition, the plants of subsidiary companies, the Chicago Heights Bottle Company of Chicago Heights, Illinois, making special bottles by the hand process; the Tavern Rock Sand Company, with plants in Missouri and New Jersey, for supplying glass sand; the Carlyle Paper Company at Carlyle, Illinois, for supplying paper cartons and shipping packages for bottles, and the Madison Warehouse Company at Boston, affording warehouse facilities for distribution of bottles in the New Englnd territory.

The article on page 92 is continued on page 93.

These additions to the facilities of the Owens Bottle Company which already owns large factories in Toledo, Ohio, Huntington, Fairmont, Clarksburg and Charleston, West Virginia, and Glassboro, New Jersey, will tremendously strengthen the Owens Bottle Company's position as a manufacturer of bottles and give it unequalled facilities for supplying the trade.

The principal executives and other members of the two organizations will remain with the new company, which will insure the efficient service and friendly relationships which have existed in the past. William H. Boshart will continue as president of the company. William E. Levis, who is president of the Illinois Glass Company, will be the first vice-president and general manager. The Owens Company's offices will be continued at Toledo, as heretofore.

Stockholders to Vote Approval

The plan for the merger will be submitted to stockholders at the annual meeting to be held at Toledo, Wednesday, at 2 o'clock P. M., in the auditorium of the Toledo Chamber of Commerce, at the Richardson Building, at Jefferson and St. Clair streets, and upon their approval it will become effective. At this meeting the annual report will be submitted, and the stockholders will be asked to authorize changes of the Company's Articles of Incorporation and Code of Regulations necessary to make the deal effective.

Notice of the annual meeting of stockholders dated March 28, 1929, contains the following statements:

> "The officers of the Company, pursuant to authority given by the Board of Directors, have made an agreement with the Illinois Glass Company for the acquisition of substantially all the assets and good will of the Illinois Glass Company and its subsidiary companies, as of January 1, 1929, for a consideration consisting of $5,000,000 cash to retire the present existing debenture issue of the Illinois Glass Company, and all other liabilities of Illinois Glass Company and subsidiaries which become a part of our company, and the following securities: $8,000,000 par value of 6% cumulative preferred stock; 20,000 shares of common stock; $5,000,000 par value of 5% ten year debentures of this Company; with dividends or interest as from January 1, 1929. The agreement also provides for the changing of the name of this Company to the Owens-Illinois Glass Company in order to better represent and preserve the good will and business of the two companies. The agreement is subject, among other

things, to the action of the stockholders of this Company necessary to authorize the issuance of the six per cent (6%) preferred stock, which is to be effected by changing the authorized but unissued seven per cent (7%) cumulative preferred stock of the Company, redeemable at $115 per share and accrued unpaid dividends, into a like amount of six per cent (6%) cumulative preferred stock, redeemable at $110 per share and accrued unpaid dividends. The proposed acquisition will provide the Company with additional factories in strategic locations from which deliveries of our products can be made with advantage to the Company and its customers, and will permit many economies in the cost of production by eliminating duplication of facilities and effort.

"The business to be transacted at the said meeting will include the consideration and acting upon proposals:

1. To amend the Article of Incorporation to change the name of the Company to the Owens-Illinois Glass Company, and to change the authorized but unissued 7% cumulative preferred stock redeemable at $115 per share and accrued unpaid dividends into 6% cumulative preferred stock redeemable at $110 per share and accrued unpaid dividends and having voting power share for share with the common stock for the election of directors only and to change other preferences and limitations of such preferred stock.
2. To amend the Code of Regulations to provide for Notices of Meetings in conformity with the new corporation laws of Ohio; to redefine the duties of the Treasurer and General Manager; to provide in what manner the number of directors for any year shall be determined; to provide that no moneys shall be borrowed by the Company except upon authority from the Board of Directors or the Executive Committee and on obligations signed or countersigned by two officers or persons duly authorized; to further provide for the issuance of duplicate certificates of stock in lieu of certificates mutilated, lost or destroyed.
3. To determine the number of, and to elect directors for the ensuing year.
4. To receive and act upon the Annual Report of the Board of Directors.
5. To approve the acts of stockholders, directors and officers, shown on the books and records of the Company, at and since the last Annual Meeting of the Stockholders.
6. To do all things incident to the foregoing or that may otherwise be properly brought before the meeting.

"The holders of the common stock will be entitled to vote according to the number of shares of stock by them respectively held of record at 3:00 o'clock p. m., on the 16th day of March, 1929.

"Each holder of common stock, however small or large his holding and even though he may expect to attend the meeting in person, is urgently requested immediately to execute the attached proxy, to have his signature thereto attested by a witness and to mail the same to the Company. During the personal presence of any stockholder at the meeting the powers of his proxy will be suspended."

A letter dated March 27, 1929, sent by President Boshart to members of the Owens Bottle Company's organization announcing the merger contains the following statements:

"The necessities of modern business in our progressive nation have resulted in numerous mergers in practically every line of manufacture and trade. In the struggle of modern industries those companies will survive and achieve preeminence which are most firmly entrenched financially and in the good will of their trade; whose factories are most efficient; whose managements are most capable and above all, whose working organizations are most loyal and effective. The combined companies will have every one of these requisites, and in addition, a selling organization and manufacturing facilities unequalled in the glass container industry. We foresee a long and prosperous existence for The Owens-Illonois Glass Company.

"The success that we confidently expect will attend the operations of our Company, will bring greater opportunities and a wider outlook for the deserving employees of both organizations. Those who are doing their work capably will benefit and advance with the growth of the Company.

"The management has always been proud of its splendid organization, and we feel that our employees are proud of the remarkable history and character of the Company of which they are a part. We bespeak a continuance of this mutual good feeling, and give our assurance that all reasonable consideration will be given to the rights of every employee."

Another letter dated March 28 sent to the customers of the Owens Bottle Company contains the statement that the combined manufacturing facilities and the well located plants and sales offices will enable the new company to render even better service to their customers than they have been able to render in the past. In this letter Mr. Boshart says: "It is our faith and hope that we will be able to pass on to our customers some of the benefits that will arise from the economies in production and distribution which will come from the merger of these two businesses. On that basis, we solicit the continuation and enlargement of the business which we have enjoyed from you."

Illinois Glass History

The Illinois Glass Company was established in 1873 by William Elliott Smith and Edward Levis. Mr. Levis left six sons and under their management the company gradually expanded until it became one of the largest in the industry. When the Owens bottle-blowing machine was perfected, the Illinois Glass Company's management foresaw its great possibilities and they obtained a license to manufacture prescription and proprietary ware, which has since been broadened to include practically all lines of bottles. In addition, it also operates under the Hartford-Empire automatic process of bottle manufacture, giving it the choice of the two processes recognized as foremost in the art. The control has remained in the Levis family, and William E. Levis, a grandson of the founder, is now in charge of its operations. He has agreed to become actively associated with the Owens Company as a Vice-President and General Manager, Director and member of its Executive Committee, and it is expected that a large part of the Illinois Company's administrative, selling and operating organization will be taken over, so that the same individuals who have been responsible for its past success will continue in charge, so far as possible.

The Owens Bottle Company

Founded on the revolutionary invention of Michael J. Owens, The Owens Bottle Company gradually developed under his guidance, and that of the late Edward D. Libbey, as a licensing company, collecting royalties from users of its automatic bottle-making machinery. At a later date, it became also a bottle-manufacturing company using Owens machines and Hartford-Empire machines, and its rapid growth has been one of the romances of American business.

Upon the retirement of Mr. Libbey in June, 1925, the presidency was assumed by William H. Boshart. Under his direction the existing plants of the Owens Company have been greatly enlarged and improved.

Numerous attempts have been made over the past ten

years to purchase or merge the Owens Bottle and Illinois Glass companies, whose interests have always been so closely allied, but it was not until now that a common basis was found.

Financial

There will be no public offering of securities as the entire issue of bonds and stocks will go to the Illinois Glass Company, and will be held by them as a permanent investment.

The Owens Company at present has no obligations of any kind outstanding ahead of its 807,000 shares of common stock, having retired all of its 7% preferred stock during the last two years out of treasury funds. The common stock has a value, based on current quotations, in excess of $75,000,000. According to the latest figures available the Owens Company has cash, government and marketable securities of approximately $6,000,000, and a total working capital of approximately $14,000,000, which will be still further increased after the consolidation. After issuance of the new securities the Owens Company will have the following bonds and stock outstanding:

10 year 5% debentures	$5,000,000
6% preferred stock ($100 par value)	8,000,000
Common stock ($25 par value)	20,175,000

Regular dividends are being paid on Owens Bottle common stock at the rate of $4.00 per share annually, and for the last four years extra dividends of 5 per cent in stock have been paid.

The Company's present board of directors consists of William Ford, Chairman; William H. Boshart, president; Frederick L. Geddes and Harry E. Collin, all of Toledo, Ohio; Charles Boldt, Charles H. Sabin, Marshall Field, E. P. Currier and Francis H. McAdoo, of New York City, and Fred W. Schwenck, of Cincinnati, Ohio. Messrs. Ford, Boshart, Collin, Field and Boldt constitute the Executive Committee.

The consolidated balance sheet and income and expense statement of the Owens Bottle Company and its subsidiaries is given below.

CONSOLIDATED BALANCE SHEET

THE OWENS BOTTLE COMPANY—TOLEDO, OHIO, AND SUBSIDIARIES

At the Close of Business, December 31, 1928

ASSETS

CURRENT			
Cash and U. S. Government Securities			$4,218,069.80
Federal Land Bank Bonds (Securities and Bonds at cost, plus accrued interest)			1,640,149.45
Notes and acceptances Receivable	$378,067.59		
Accounts Receivable	2,359,323.30	$2,737,390.89	
Less: Allowance for Doubtful, etc.		252,357.64	2,485,033.25
Inventory—At Cost Finished Product, In Process Glass, Raw Materials and Shipping Supplies	$4,605,636.57		
Factory Supplies and Repair Parts	1,264,324.47		
			5,870,011.04
			$14,213,263.54
INVESTMENTS IN CONTROLLED AND OTHER COMPANIES			749,621.65
OTHER ASSETS			
Cash Deposits for Gas Lines, Insurance, etc.		$212,543.33	
Cash Surrender Value of Life Insurance		469,576.15	
Miscellaneous Notes and Accounts		263,300.53	
Other Real Estate		812,629.48	1,758,049.49
PERMANENT—As appraised at Sound Value by Independent Appraisers as of February 21, 1916, with subsequent additions, deductions and allowance for depreciation			
Land, Buildings, Machinery, Equipment, etc.	$21,405,792.09		
Less: Allowance for Depreciation	10,657,383.28		10,748,408.81
GAS PROPERTIES, PLANT, LEASES, WELLS AND EQUIPMENT	$4,261,240.65		
Less: Allowance for Depletion and Depreciation	2,563,851.00		1,697,389.65
PATENT RIGHTS, LICENSES, CONTRACTS, GOODWILL, ETC.			3,558,950.28
DEFERRED			
Prepaid Expenses, Supplies, Etc.			172,791.91
			$32,898,475.33

LIABILITIES

CURRENT			
Accounts Payable—Not Due		$657,863.32	
Customers' Credit Balances and Advances		123,735.27	
Accrued Taxes, Etc.		126,346.06	
Estimated Federal Income Tax—Year 1928		503,000.00	$1,410,944.65
RESERVES			
For Repairs and Contingencies			3,079,840.15
CAPITAL STOCK			
PREFERRED 7% CUMULATIVE			
Authorized	$8,755,406.00		
Less:			
Unissued	$8,742,600.00		
In Treasury	500.00		
Called for Redemption	12,300.00	8,755,400.00	
COMMON—PAR VALUE $25.00			
Authorized	$30,000,000.00		
Less: Unissued	10,778,850.00	19,221,150.00	19,221,150.00
SURPLUS			
Balance December 31, 1928			9,186,540.53

NOTE—Cash Dividends on Common Stock payable January 1, 1929, amounting to $768,846.00, were paid to the Disbursing Agent prior to the close of business December 31, 1928.
Common Stock Dividend of 5% payable in Common Stock and Scrip on January 1, 1929, has not been provided for in this Balance Sheet.
The Company was reported contingently liable at December 31, 1928, as endorsers on Letter of Credit and Trade Acceptances, amounting to $55,213.92.

$32,898,475.33

CONSOLIDATED INCOME AND EXPENSE STATEMENT

THE OWENS BOTTLE COMPANY, TOLEDO, OHIO, AND SUBSIDIARIES

For the year ended December 31, 1928

INCOME

MANUFACTURING PROFIT after deducting Materials Used, Labor, Royalties, and Manufacturing Expense		$5,416,718.76
LESS: DEPRECIATION		909,216.25
NET MANUFACTURING PROFIT		$4,507,502.51
ROYALTIES:		
Controlled Companies and Owens Factories	$1,447,587.44	
Licensed and Other Companies	1,064,747.80	2,512,335.24
TOTAL MANUFACTURING PROFIT AND ROYALTIES		$7,019,837.75
OTHER INCOME		
Interest Earned	$313,648.77	
Realized Profit on Sale of Foreign Rights, Purchase Discounts, Etc.	19,554.76	
Profit—Gas and Miscellaneous Departments	73,132.50	
Profit on Sale of Securities	29,462.56	
Dividends on Stock Owned	18,780.50	454,579.09
Total INCOME		$7,474,416.84
EXPENSE AND OTHER CHARGES		
Administrative, Selling, Patent and Royalty Expense, Machine Development, Provision for Doubtful Accounts, Loss on Equipment Sold and Scrapped, etc.		2,960,097.37
PROFIT BEFORE PROVIDING FOR FEDERAL INCOME TAX		$4,514,319.47
PROVISION FOR ESTIMATED FEDERAL INCOME TAX		503,000.00
NET PROFIT		$4,011,319.47

A detailed statement of your Company's physical condition and operations will be contained in the Annual Report which will be submitted to the Stockholders' Meeting of April 17th, and at the same time will be mailed to all stockholders. You are urged to be present at this meeting.

HENRY W. CARTER, Treasurer

W. H. BOSHART, President

Toledo, Ohio, March 28, 1929.

The absorption of the executive departments of the Illinois Glass Company whose activities will be transferred to Toledo will undoubtedly have a marked effect eventually on the further development of Toledo as the center of the glass manufacturing industry of America.

Making the Plant Physically Safe

Accident Prevention

By W. Graham Cole[1]

PROVISION for the physical safety of a plant should be the first item on the program for a safety campaign if it is to be successful. Mechanical guarding of dangerous machines and places is required by law in most states, as well as by casualty insurance companies. Since it is only a matter of time before all states will require thoroughgoing mechanical guarding, the installation of guards before such time should follow standards which will later meet state requirements.

The cost of making a plant physically safe is nearly always promptly repaid by increased efficiency of production, to say nothing of the savings in compensation or insurance costs. For example, the effort to make punch presses safe resulted in fundamental revision of the methods of feeding material to the press which permits one man to do the work formerly done by several. On other machines, safeguarding requirements have necessitated changes which, instead of interfering with production, have speeded it up. If, in addition to guards, there are places on the walls for tools to be hung, and hall spaces where other equipment can be kept in orderly condition, workmen will be less likely to trip, and time will not be wasted in search for lost tools or equipment.

The best machine guard is the one built as part of a machine rather than something to be attached to the machine or placed around it. Orders for new machines should, therefore, include specifications for guards, though many manufacturers are making guards a part of all machines even when this is not specified by the buyer.

Both state laws and good practice require the guarding of all moving parts with which anyone can come in contact. The necessary guards can be made in the plant by any able mechanic, using materials usually available in most plants or which can be purchased from any of the several companies which make such materials. In a large plant, it is advisable to set up a separate department which will be responsible for the construction, installation and repair of all guards. In a small plant the construction of guards should be delegated to a good mechanic who should be permitted to spend as much time as is necessary at this work.

It has been found better to assign the guard making work of the entire plant to one man rather than to a different man in each department. A man will take greater interest in guarding and become more expert in the work when it is his most important job, than several men to whom constructing guards is of secondary importance. The one guard maker can also develop a standard type of guard for the whole plant, saving money and bringing about a desirable uniformity of appearance. State labor and insurance company codes should be consulted, to be sure that the construction of guards conforms with state and insurance standards. Codes for guarding can also be obtained from the Bureau of Labor Statistics of the United States Government and from various safety organizations.

A good guard must meet several requirements. It should be neat in appearance, since neatness is one indication of safe conditions. It should be durable, able to withstand any impacts to which it may be subjected. It should be practical, not interfering in any way with the operation of the machine. It should be easy to remove and replace, and not attached to the machine in such a way that it cannot be removed quickly when repairs are necessary. Unless its construction is such that it can be put together again quickly, it is likely to be left off for days or weeks after the machine has been moved or repaired. A guard which is removed and not replaced constitutes a greater hazard than no guard at all, since the workman has become used to it and will be more susceptible to accident without it. Ordinarily it is best to construct the guard on hinges so that it can be opened easily for oiling and inspection.

Since the cooperation of workmen is necessary in their use, the men should be convinced that guards help rather than hinder them. Often a workman can be led to make a good suggestion about a guard, which assures his cooperation when the guard is adopted.

For ultimate economy, guards should not, in most cases, be made of wood which is weak and expensive to replace. Wood also constitutes a fire hazard, especially when oil-soaked. It is, however, necessary in plants where acids are used, and it may be desirable in woodworking plants or in temporary plants. Good guards can be made of wire mesh or of one of the several perforated or expanded metals manufactured for this purpose.

Real as well as apparent hazards should be sought out and guarded. The oiler goes to the most hazardous places in a plant, and is often injured. Such places should, therefore, be guarded, even if no one goes there but the oiler, and he infrequently.

Belts or gears are found in practically every plant, and their guarding, which is typical of all guarding, may be mentioned briefly. Most state laws require the guarding of belts to a height of at least six feet above the floor. Safe practice requires that belts should be always guarded to above the point where belt meets pulley, and where clothing or other things might be caught. Cast iron foot rests or sockets screwed to the floor, with angle irons placed in these and held by set screws provide a good basis for the construction of substantial belt guards which are easily removed. The material of which the guard is to be made is attached to the angle irons. Through the use of hinges or latches to hold the material, any portion of the guard can be opened or removed easily to permit repair.

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[1] Lecturer on Accident Prevention, New York University.

The article on the next page is continued from page 92.

just what their money would be used for by the company.

Following the catalog, a four-page folder was sent out which was devoted exclusively to the bond issue. The purpose of the issue was fully explained, as well as the manner in which the money would be protected, the condition of the company, its past record, and what it might be expected to accomplish within the next few years. These folders were mailed out to bankers, brokers, and business men.

It is interesting to note again that direct by mail literature was used exclusively in every instance. There was no follow-up in newspapers, magazines, trade papers or other mediums. Only the mails were used. From 3,500 of these folders mailed out several hundred inquiries were received, and, although the bonds have been offered only a few weeks at the time this is written, more than half the issue has been sold without additional effort.

"One of the things that appealed to us in selecting direct by mail as a means of increasing business," the advertising director explained, in discussing their experience, "was the fact that we had a special class of people to whom to direct our appeal. We could not 'see' newspaper advertising, since only an extremely small percentage of the readers would be interested in glass bottles. Other mediums were the same. Direct by mail gave us that individual appeal we were seeking.

"Our catalogs were received with enthusiasm. They were just what were required, especially during the busy season when new bottles were needed in a hurry; and they were of real interest to manufacturers of soft drinks just starting out who were seeking a new bottle.

"In the same way this appeal was carried to the dairy men and the packers of fruits, vegetables, candies, fish and other edibles. Our containers are now used for shrimp, shelled pecans, candy, jams, jellies, pickles, catsup, drugs and medicines, and many other products. It is getting our products before persons who might have a use for them that has helped us to build up a very fine business.

"We were so well satisfied with the results obtained from our first advertising that, when we were planning our bond issue, we decided to use the same means for putting this over. Our returns on this have been greater than we planned. The catalogs that were first sent out paved the way for our folder and broke down the sales resistance that generally exists on such occasions."

The development of a business of $16,526 in volume in 1923 to one having an approximate volume of $573,500 in 1928 tells in a few words the story of the Three Rivers Glass Company's five years of existence.

Glass Cutting, Staining and Ornamenting Census

The Department of Commerce on March 9 released the Census Bureau's report of data collected at the biennial census of manufacturers taken in 1928 on glass cutting, staining, and ornamenting. The establishments engaged primarily in this kind of work in 1927 reported products valued at $22,327,581, a decrease of 20.1 per cent as compared with $27,943,048 for 1925, the last preceding census year.

In addition, glass cutting, staining, and ornamenting are done to some extent by establishments engaged primarily in other industries. The value of such work thus done outside the industry proper in 1925 was $6,281,810, of which amount $3,984,087 represents the value of cut ware and decorated glassware made in the glass-manufacturing industry and $2,297,723 represents the value of glass cutting, staining, and ornamenting done as a secondary activity in other industries. The total amount is equal to 22.5 per cent of the total value of products reported for the industry as constituted. The corresponding amount for 1927 has not yet been ascertained, but will be shown in the final report of the present census.

The establishments in this industry are engaged principally in the production of stained, ornamented, and leaded windows and art-glass products, in bending, polishing, and engraving sheet glass, in cutting and etching glass tableware, and in manufacturing druggists' glassware and other commodities from purchased tubing.

Of the 400 establishments reporting for 1927, 98 were located in New York, 63 in Pennsylvania, 33 in Illinois, 33 in New Jersey, 33 in Ohio, 23 in California, 22 in Massachusetts, 14 in Missouri, 14 in Wisconsin, 10 in Indiana, 8 in Maryland, 7 in Texas, 6 in Connecticut, 5 in Michigan, 5 in Minnesota, 5 in West Virginia, 3 in Rhode Island, 2 each in Colorado, Georgia, Iowa, Kentucky, and Washington, and 1 each in the District of Columbia, Florida, Idaho, Kansas, Maine, Nebraska, North Carolina, and Oregon. In 1925, the industry was represented by 410 establishments, the decrease to 400 being the net result of losses and gains. Of the establishments lost, some went out of business prior to 1927, some were engaged primarily in lines of manufacture other than glass cutting, staining, and ornamenting and were therefore transferred to the appropriate industries and others reported products valued at less than $5,000 for 1927. (No data are tabulated at the biennial censuses for establishments with products under $5,000 in value.) Of the establishments gained, part were engaged primarily in lines of manufacture other than glass cutting, staining, and ornamenting in 1925 and the remainder reported for the first time at the present census.

	1927	1925	% of decrease
Number of establishments	400	410	—2.4
Wage earners (average for the year)[1]	4,465	4,860	—8.1
Wages[2]	$ 6,214,552	$ 6,516,711	—4.6
Cost of materials, shop supplies, fuel, and purch. power, total[2]	$ 8,778,568	$13,330,933	—34.1
Materials and supplies	$ 8,461,296	([3])	....
Fuel and power	$ 317,272	([3])	....
Value of products[2]	$22,327,581	$27,943,048	—20.1
Value added by manufacture[4]	$13,549,013	$14,612,115	—7.3
Horsepower	3,316	3,531	—6.1

[1] Not including salaried employees.

[2] The amount of manufacturers' profits can not be calculated from the census figures, for the reason that no data are collected in regard to a number of items of expense, such as interest on investment, rent, depreciation, taxes, insurance, and advertising.

[3] Not reported separately.

[4] Value of products less cost of materials, shop supplies, fuel, and purchased power.

Glass Industry

ESTABLISHED 1920

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Secret Mixtures

Before the introduction of modern chemistry into glass manufacturing, batch compounding was an art known only to a comparatively restricted number. In those days it was possible to keep batch compositions a secret. The addition of secret mixtures to be added to glass batches with the object of producing certain properties, or color effects was common and was considered quite proper. It was entirely in keeping with the traditions of the craft and with the trend of the times.

This condition has persisted abroad to some extent, although even in the more conservative countries it has become a practice that has fallen into discredit to a large degree.

In this country there is no reputable manufacturer of glass making materials that seriously considers to revive the practice of offering for sale secret mixtures for which exaggerated claims are put forth. However, there are importers who do not understand present conditions of the glass industry and who are so ill-advised as to make the attempt. They are not aware of the fact that the glass manufacturer of today knows perfectly well what his batches contain, and that his materials are bought on strict specifications. They believe that a high pressure salesman with a good selling argument can accomplish anything that he has set out to do.

Recently one of these mixtures said to produce "a strong and brilliant glass" has appeared on the market and is being offered for sale to glassmakers in this country. The material bears a fancy name and is sold at a corresponding price. Analysis has proven it to be a mixture consisting chiefly of silica, lime and alumina. Its addition to a glass batch will undoubtedly improve the glass somewhat, due to the presence of alumina which is introduced into glass in this manner. Every glassmaker knows that alumina has a tendency to render glass resistant against bloom and weathering, that it improves the working qualities of glass and increases its strength. Consequently the sale of alumina bearing materials to the glass trade has increased considerably during the past few years and is still growing rapidly.

But to sell alumina, or any other glass making material, under a trade name is of doubtful propriety, even if the price is not excessive. At the present stage of glass manufacturing an offer of material of this description is not flattering to the intelligence of a glass manufacturer and should be treated as not in accord with modern trade practices.

Shall We Have a Chemist?

By S. R. SCHOLES

Technical Director, Fostoria Glass Company

This question is asked of themselves by many owners of small glass factories.

Recital of the following occurrence may help to show that, considered merely as a safe-guard against blunders in technique, the glass-chemist may be worth much more than he costs.

In a certain one-tank plant, a new tank-furnace was

fired and filled. The ware, consisting of machine-made bottles, was bad from the start. The glass was badly distributed, thin spots appeared in the bottles, and the breakage loss was disastrous. These results were laid to the design of the new tank, to the low tonnage, to firing method,—until after weeks of operating at a loss, the real trouble was found.

The scales on which the soda ash was weighed were in error just 100 pounds! It is obvious that 100 pounds extra soda ash in each batch would make a glass of entirely different working properties from that expected, especially where the total batch weight was less than 1,300 pounds.

Upon discovery of this error, the scales were corrected, and properly proportioned batch fed to the tank. Naturally, however, matters were even worse for a time, while a batch producing a glass of lower density and higher viscosity was gradually displacing the contents of the tank.

At this point an expert was called in, but before a normal flow of correctly made glass could be established, the total loss sustained ran into thousands of dollars.

With a chemist on the job, whether he analyzed the glass, tested the scales, analyzed the batch, or even only made a few specific gravity determinations, the source of the trouble would have been found almost at once—if indeed the error had ever been allowed to arise. This is no attempt to claim infallibility for chemists, but a man with laboratory training is far less likely to lose control of compositions than is one to whom the ways and properties of raw materials and melted glass are known only by experience.

Technical Consultation Service

Silvering and Backing Mirrors

Question 116.—Kindly send us as full information as possible regarding methods of replating and backing mirrors.

Answer.—In silvering mirrors, it is important to have the glass surface absolutely clean. To clean off paint and silver a solution of nitric acid and water (50:50) is recommended. This can be done in a tank, lined with asphalt pitch, tempered with tar. The pitch should be applied to the tank in a molten state. A lead lined tank can also be used.

New glass must be washed with gasoline, followed by washing with soap and water. The surface is then cleaned with ammonia, and nitric acid, and finally with distilled water.

We give below a formula for silvering, which has been found to be entirely satisfactory, also directions for the preparation of lacquer, for the protection of the silver deposit.

Glass Silvering Process

1. *Silver Solution.*

Dissolve 5 grams of silver nitrate in 300 cubic centimeters of distilled water and add dilute ammonia water until the precipitate formed is nearly *but not entirely* redissolved. If by chance too much ammonia has been used, a little silver nitrate is to be dissolved and added a few drops at a time, till a permanent precipitate is formed. This excess of silver must be present, the solution showing a decided brown tint. This solution may be filtered, though usually this is not necessary. Dilute to 500 cubic centimeters with distilled water and mix.

2. *Reducing Solution.*

Dissolve one gram of silver nitrate in a small quantity of water and pour into about half a liter of boiling water. Dissolve 0.8 gram of Rochelle salts in a small quantity of water and add to the boiling solution. Continue the boiling for half an hour till the gray precipitate collects as a powder on the bottom of the flask. Filter and dilute to 500 cubic centimeters with distilled water.

These solutions should be kept in the dark and will keep their strength for about two months.

For silvering, equal volumes of the two solutions are mixed, and applied to the glass surface.

Lacquer for Silvered Mirrors

Melt 4 parts of Venetian turpentine and mix with 8 parts of orange shellac. Heat and stir until a good mixture is obtained. Allow to cool and add 32 parts of 75 per cent alcohol. Mix and filter through a linen cloth.

Early Days in the Plate Glass Industry

According to E. J. Langland of Butler, Pa., whose father, James Langland died last November, his grandfather on his mother's side, Thomas Leyland, ground the first polished plate glass in America at New Albany, near Jeffersonville, Ind. Mr. Langland states that his mother remembers living in New Albany when a girl, and coming with her family to Pennsylvania with Captain Ford when natural gas was discovered. She tells of many times when the river was so low that Captain Ford could not get coal for his glass plant, so when gas was discovered he struck out for Pennsylvania. An interesting little story about how Captain Ford came to locate in that section is told.

There was a distillery near the glass plant and every morning Captain Ford would drop in to look the place over. One day when coal was lacking he met there a new man who had just come from Freeport, Pa., who told him there was something coming out of the ground there that had caught fire and he believed it could be used for fuel in place of coal. This, according to the story was the beginning of Captain Ford's establishment of the first plate glass plant in that section. The earlier plant at New Albany made only eight plates a day and "it was a bad day for the foreman if the eight plates did not reach the wareroom regularly."

On December 13, 1923, Thomas Leyland, who at one time was vice-president of the Skilled Plate Glass Workers International Union, died, in his fifty-second year, at Charleroi, Pa. According to a newspaper clipping in the possession of E. J. Langland, now living in Butler, Pa., he came to America from England and, as stated above, ground the first plate glass ever ground in America at New Albany, Indiana, while in the employ of Captain J. B. Ford.

Secret of Rouge Making

Discussing recently the present day methods of polishing plate glass, Mr. Langland, whose family has handed down for several generations many old traditions and lessons learned from experience regarding the manufacture and use of polishing rouge, says:

"You know, rouge is a peculiar article and it was always a great delight to Dad and myself to read some of the articles written about rouge. It seems that about 90 per cent of them are hocus-pocus, written by men who either don't know or by men who want to deceive some one.

"But after all that is not the real issue in rouge polishing. Some people have the idea that all you have to do is mix a little water with it and pour it on the table and expect by some miracle, presto, the smooth is gone.

"It is true that you can remove the smooth by felt and rouge, any rouge, possibly, but to remove the smooth with the right kind of rouge whereby you get a brilliant finish on the glass with the aid of felt, not by the felt, is a different matter.

"A felt finish on plate glass is costly. With the right kind of rouge you can save as high as fifty per cent of felt. By the right kind of rouge, I mean to suit the machine. For instance a 25-foot round table requires a different rouge from a 36-foot table. And no rouge used on that size table will work on a square table to give it a 'rouge' finish.

"Some people will say that it is all in how you mix it. Yes, a good bit is in the mixing if you are getting a 'felt' finish, but it has always been our pride that, after we ascertain what your machine requires, a school boy could mix it and never go wrong, as the real secret of rouge is in the making, where you make it to suit the machine in the kilns where the rouge is treated."

Production of soda ash in Japan which in 1925 was only 12,304 tons was estimated unofficially at 35,000 tons in 1928. About 100,000 tons were imported.

Rutgers Ceramic Exposition

A NEW custom which seems likely to become an annual habit and one which could well be imitated perhaps by other educational institutions which give courses in Ceramics, was innovated by The Ceramic Club of Rutgers University at New Brunswick, N. J., on March 8, when a Ceramic Exposition conducted by the students in the Ceramic Department of the University was opened in the main assembly room of the ceramics building and in two class rooms and the laboratory.

Manufacturers of ceramic products in New Jersey had been requested to supply specimens of their wares—no charge being made for the space allotted to them. In connection with the exhibits there were also demonstrations in the laboratories by students and others of the processes involved in the manufacture of the various products. These included: glass melting, firing of pottery, brickmaking, throwing, casting and pressing of pottery wares, enameling, glass blowing, and so forth.

The exhibits were arranged in three groups. First, pottery, terra cotta, floor and wall tile, electrical porcelains; second, heavy clay products and refractories; third, the glass exhibits and raw materials. Exhibits of scientific glassware, enamels, etc., were displayed in the chemical laboratory.

The glass exhibitors included the following:

Gayner Glass Works, Salem, N. J.—Large bottles, carboys and containers.

Harrison Bulb Works of General Electric Company, Harrison, N. J.—Incandescent lamp bulbs.

Illinois Glass Company, Bridgeton, N. J.—Glass bottles.

Kimble Glass Company, Vineland, N. J.—Scientific glass wares.

Salem Glass Works, Salem, N. J.—Glass bottles.

Tavern Rock Sand Company, Millville, N. J.—New Jersey glass sand.

Vineland Flint Glass Works, Vineland, N. J.—Art glass wares.

T. C. Wheaton Company, Millville, N. J.—Colored glass wares for cosmetics, etc.

Whitall Tatum Co., Millville, N. J.—Glass bottles of all kinds.

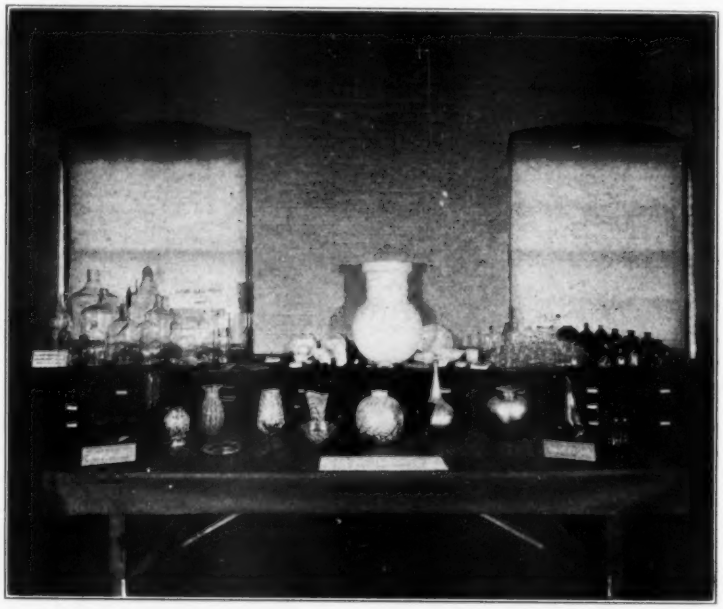
Thermal Syndicate, Brooklyn, N. Y.—Fused quartz.

The line of art glassware exhibited in both the main assembly room and one of the class rooms by the Vineland Flint Glass Works received much favorable comment. Many visitors were unaware that art ware of such high quality was made in New Jersey.

A feature of interest especially appropriate because of the laboratory experiments which were carried on for the edification of those present, was the samples of raw materials shown by producers and manufacturers which included feldspar and other ceramic materials: Consolidated Feldspar Corporation, Trenton, N. J., Kaolin by Edgar Plastic Kaolin Company, Metuchen, N. J., and a card showed that the Gayner Glass Works products at the exhibition were made with purified glass sand from the Tavern Rock Sand Company, Millville, N. J.

The willing cooperation of the manufacturers resulted in a most creditable display of glassware, china, pottery and other products. The many beautiful and useful objects shown created wide interest, and impressed on the minds of a large proportion of the 1,800 visitors who attended during the six days the exhibition was open, a much more adequate conception of the ceramic resources of the State than they had previously possessed. The register showed visitors from eight different states and sixty-four different cities in New Jersey. Numerous requests have been received to make the exposition an annual affair. The enterprise involved a great deal of work on the part of Professor G. H. Brown, Director of the Department of Ceramics and the staff and students, but they feel very gratified with its success.

It was originally intended to continue the exhibit only two days but its popularity led to a six day run.



PART OF THE GLASS EXHIBIT

On upper level, left to right, the products shown in the first exhibit were made by the Gayner Glass Works; at the center, Thermal Syndicate; at the right, Illinois Glass Company. On the table in the foreground are specimens of Durand Art Glass made by the Vineland Flint Glass Works.

MORE OF THE GLASS EXHIBIT

The displays, left to right, are those of Edgar Plastic Kaolin Company, Consolidated Feldspar Corporation, Golding Sons Company and Erwin Feldspar Company. At right, Whitall Tatum Company, T. C. Wheaton Company, and Salem Glass Company.

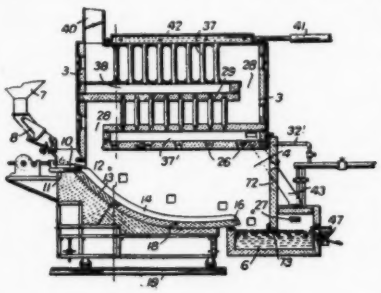
Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

AN IMPROVED METHOD OF GLASS MELTING. R. L. Frink, Ohio, U. S. A. (Brit. Pat. No. 291,863, March 11, 1927; from *Ill. Official J. Pat.*, No. 2063, Aug. 1, 1929.)

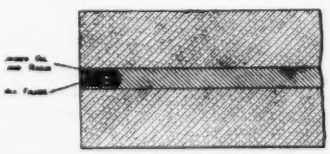
A method of melting glass consists in feeding the batch material on to a surface which is inclined or curved downwards and on which the material is exposed to heat while spread out in a relatively thin layer. The material melts and flows down the surface until it runs off into a collecting chamber or receptacle. The furnace comprises a body portion containing the regenerators, and a hearth or sole, 13, having its upper surface inclined, as shown. The sole may be built up, or may be cast in one piece. The inclined surface may also consist of a layer of refractory material having a low coefficient of expansion, such as sillimanite, and it is formed with upturned sides, 14, so as to form a shoot for the batch material. The shoot may be carried by a movable truck, 18, running on rails, 19, to enable it to be replaced quickly when the blocks are eroded, a spare shoot being kept ready in a heating furnace.



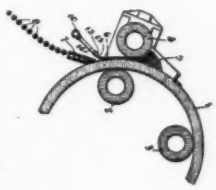
The furnace body comprises end walls, 3, and side walls, 4, the bottom being formed as a container, 6, having an inner wall which is overlapped by the lower end, 16, of the sole, 13. The upper part of the body contains recuperator chambers, 37^1, 38, 42, which are connected by tubes, 29, 37, the lowest chamber, 37^1, being formed with burner ports, 26. The chamber 37^1, also communicates by a flue, 43, with burner ports, 27, in the walls of the container, 6. The chambers form with the wall of the furnace a flue, 28, that conducts burnt gases to the stack. 40. A hanging mantle, 72, which closes the working end of the furnace, extends downwards to a floater, 73, under which the glass must pass to the working-out point. The working chamber, to the right of the mantle, is heated by the burners, 27.

In use, air supplied from a pipe, 41, passes through the recuperators, 42, 38, 37^1, and is mixed in the burners 26, with fuel, either oil or gas, supplied by pipes, 32^1. The combustion of the gases heats the sole, 13, and the burnt gases, passing out through the flue, 28, heat the recuperators. The batch is supplied from a bin, 7, through a gate, 8, to a container which may have its floor, 11, water-cooled. A reciprocating plunger 10, pushes the batch out of the container through an opening, 12. The plunger is a loose fit in the opening, 12, in order to prevent jamming. The batch thus fed on the heated sole moves downwards by gravity and melts during the movement. The molten glass so formed runs off the lower end, 16, into the container, 6, where it is worked out in any suitable manner. The container may have a variable outlet slot, 47, for use in the formation of sheet glass, as described in Specification 292,448.—*Journal of the Society of Glass Technology.*

WEATHERPROOF LAMINATED GLASS. U. S. 1,705,631. Mar. 19, 1929. Louis Bartelstone, Brooklyn, N. Y., assignor to Indestructo Glass Corporation. Filed Oct. 26, 1929. A permanentized sheet of laminated glass comprising an intervening sheet of organic material and external panes of glass, the edges of the intervening sheet being spaced inwardly from those of the glass to form a narrow channel; a film of linseed oil and rosin covering the edge of the sheet and the inner surfaces of the protruding margins of the glass panes; and a wax filler for the residual channel.

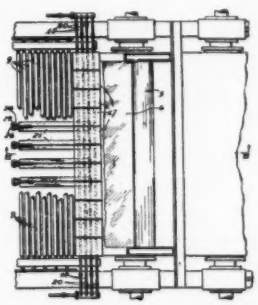


PROCESS AND APPARATUS FOR MAKING SHEET GLASS. U. S. 1,704,552. March 5, 1929. Dominic F. Cannon, Ford City, Pa., assignor to Pittsburgh Plate Glass Company. Filed Dec. 14, 1927. A process for holding up the advance edge of a plastic sheet of glass as it passes from a forming roll onto a runway which consists in applying a blast of fluid between the forming roll and the advancing end of the sheet to lift such end as it passes onto the end of the runway.



METHOD OF AND APPARATUS FOR FORMING GLASSWARE. U. S. 1,702,262. Feb. 19, 1929. Richard La France, Toledo, O., assignor to The Owens Bottle Company. Filed Sept. 2, 1926. The method of forming parisons which consists in drawing a measured quantity of glass into the open end of a mold by suction created at radially spaced points at the closed end of said mold, severing the glass and simultaneously closing the open end of said mold, continuing suction after closing of the mold, and substantially simultaneously cutting off the suction and applying air pressure to the glass from the closed end of the mold to give shape to the parison.

GLASS-ROLLING APPARATUS. U. S. 1,702,504. Feb. 19, 1929. John H. Fox, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company. Filed Jan. 17, 1928. In combination with a glass sizing roll, an apron for receiving the glass therefrom, comprising a tubular member adjacent the surface of the roll, means for circulating a cooling fluid therethrough, a plurality of sheet metal sections, placed end to end, surrounding said member and having tapering lips in opposition to said surface of the roll, and means for applying force at different points along the series of sections so as to resist the tendency of the sections to warp and pull said lips away from the surface of the roll.



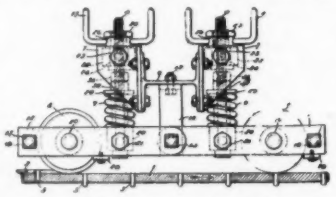
PROCESS AND APPARATUS FOR ROLLING PLATE GLASS. U. S. 1,704,580. March 5, 1929. Lee Showers, Charleroi, Pa., assignor to Pittsburgh Plate Glass Company. Filed 1/29/27. The combination with a pair of opposing horizontal rolling members, having a pocket therebetween for receiving a body of molten glass to be rolled into a sheet, of closure members fitting between the rolls and constituting the ends of the pockets and removable sheet metal plates fitting the inner faces of said closure members.

GLASS-WORKING MACHINE FOR SWITCHES. U. S. 1,701,759. Feb. 12, 1929. George A. Millar, Ridgefield Park, N. J., assignor to Cooper Hewitt Electric Company. Filed 2/5/27. In glass-working machinery, in combination, a plurality of sets of chuck jaws, means for each set tending to hold the jaws thereof in the open position, confining means for causing the jaws of each set to move into the closing position, means tending to move said jaws into their respective confining means, and a single means for moving said sets of jaws separately at will from their respective confining means to permit the opening thereof, said moving means being movable relatively into and out of position for operating either of said sets of jaws.

GLASS-BLOWING MACHINE. U. S. 1,705,341. March 12, 1929. Leonard D. Soubier, Toledo, O., assignor to The Owens Bottle

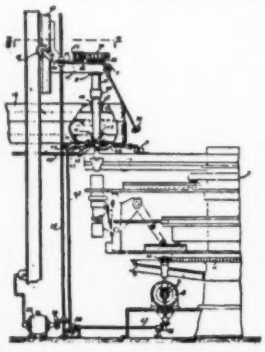
Company, Filed 8/27/28. In a glass forming machine, the combination of a blank mold carriage, a blank mold thereon, a finishing mold carriage, a finishing mold thereon, means to rotate said carriages in opposite directions, a blank holding and transferring device mounted on the blank mold carriage, means to actuate said device to transfer a blank to the finishing mold, and means operated from the blank mold carriage for guiding said device and causing it, while holding the blank, to travel with the finishing mold while the latter travels through a predetermined arc.

APPARATUS FOR CLEANING PLATE GLASS-GRINDING TABLES OR CARS. U. S. 1,705,915. Mar. 19, 1929. James Green, Brackenridge Heights, Pa., assignor to Pittsburgh Plate Glass Company. Filed Nov. 3, 1927. Apparatus for cleaning plaster from the edge of a moving surfacing table having a row of glass holding pegs projecting above the top of the table and through the plaster, comprising a device having a roller positioned so as to engage the plaster and pegs as the table moves beneath the device and means pressing said device downwardly with sufficient force to fracture the plaster and drive the pegs downward.



METHOD OF AND APPARATUS FOR FORMING GLASSWARE. U. S. 1,702,262. Feb. 19, 1929. Richard La France, Toledo, O., assignor to The Owens Bottle Company. Filed 9/2/26. The method of forming parisons which consists in drawing a measured quantity of glass into the open end of a mold by suction created at radially spaced points at the closed end of said mold, severing the glass and simultaneously closing the open end of said mold, continuing suction after closing of the mold, and subsequently simultaneously cutting off the suction and applying air pressure to the glass from the closed end of the mold to give shape to the parison.

METHOD AND APPARATUS FOR PRODUCING CHARGES OF MOLTEN GLASS. U. S. 1,692,589. Nov. 20, 1928. Leonard D. Soubier, Toledo, O., assignor to The Owens Bottle Company. Filed 3/22/26. The method of producing formed charges of molten glass which comprises causing the glass to flow form a supply body through an outlet orifice, applying pneumatic pressure to a surface of the glass beneath said orifice, confining the pressure to a narrow annular surface between the main body of the issued glass and the walls of the orifice, and periodically severing the column of glass below the point of application of pneumatic pressure, to form charges.

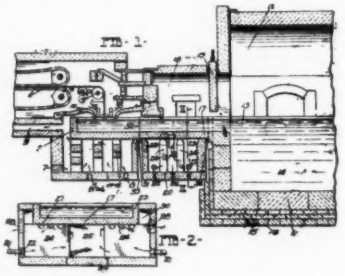


APPARATUS FOR ANNEALING SHEET GLASS. U. S. 1,698,479. Jan. 8, 1929. Vergil Mulholland, West Hartford, Conn., assignor to Hartford-Empire Company. Filed 10/14/26. The temperature control by which both the upper and lower surfaces of the sheet glass will be subjected to a uniform temperature at any given cross sectional portion of the tunnel, and in which the temperature above and below the glass may be easily regulated throughout the entire length of the tunnel, is obtained by providing a tunnel lehr having two separate and independent fire boxes, one above and one beneath the receiving end of the tunnel, and communicating respectively with heating flues extending longitudinally above and beneath the tunnel. The temperature in each of these flues is regulated at will by damper-controlled openings through which air from the outer atmosphere may be admitted into the flues in regulable quantities to dilute and cool the heated gases passing therethrough.

WIDTH-MAINTAINING MEANS FOR SHEET-GLASS APPARATUS. U. S. 1,701,161. Feb. 5, 1929. Joseph M. Neenan and James P. Weaver, Charleston, W. Va., assignors to The Libbey-Owens Sheet Glass Company, Toledo, O. Filed 12/9/26. A sheet glass apparatus, means for drawing a sheet from a mass of molten glass, including width maintaining means, and means for directing a jet of air onto the edges of the sheet before the said edges contact with said width maintaining means.

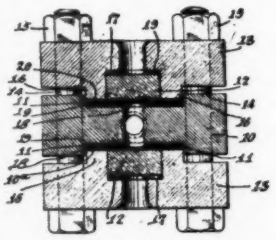
GLASS-FEEDING APPARATUS. U. S. 1,699,563. Jan. 22, 1929. Albert N. Cramer, Toledo, O., assignor to The Owens Bottle Company. Filed 9/25/26. In glass feeding apparatus, the combination of a molten glass container having a bottom outlet opening, means adjacent the opening for severing charges, a guide for the charges below the severing means, a pivoted arm carrying the guide at one end, an adjusting screw engaging the other end portion of said arm to move the arm in a horizontal plane, and spring means yieldably retaining the arm in engagement with said screw.

GLASS FURNACE. U. S. 1,695,528. Dec. 18, 1929. William K. Brownlee, Toledo, O., assignor to The Libbey-Owens Sheet Glass Company. Filed May 21, 1923. The object of the invention is to so vary the tank construction that the molten glass will maintain a more nearly equal temperature from top to bottom, and the fire will be more uniform and not confined merely to the surface strata. This is accomplished partly by adding insulations around the deeper portions of the refining tank to decrease the heat loss in this portion of the furnace, and partly by positively heating the shallower tank portion between the refining tank and the drawing point for the sheet.



APPARATUS FOR ANNEALING GLASSWARE. U. S. 1,698,480. Jan. 8, 1929. Vergil Mulholland, West Hartford, Conn., assignor to Hartford-Empire Company. Filed 10/29/26. Apparatus for annealing glassware comprising a tunnel constructed of a plurality of sections arranged in end-to-end relation and metallic sheets having bright heat reflecting surfaces secured to the walls of each of said sections, the edges of said sheets being in spaced relation to the edges of the adjacent sheets to provide for expansion caused by heat.

BOILER-GAUGE GLASS. U. S. 1,703,426. Feb. 26, 1929. Howard J. Kerr, El Mora, N. J., assignor to The Babcock & Wilcox Company. Filed Oct. 20, 1924. A steam boiler water gauge comprising a member having a cavity therein, a flexible transparent sealing member disposed over said cavity, a sight glass also extending over said cavity and disposed exteriorly of said flexible member, means to hold said sight glass in position, and means to clamp said sealing member in position without exerting substantial pressure on said sight glass.



Larger Production Per Worker

According to figures compiled by Dominick & Dominick, New York, the output per worker in this country since the beginning of the century has increased approximately 57 per cent, while the quantitative output has increased 100 per cent. During that period the increase in population has been only 55 per cent, so it is apparent that the output has increased at a much more rapid rate than the number of workers. This has all been accomplished despite the reduction in working hours. Between 1909 and 1923 the average time per week in factories was reduced by 11 per cent, and the Department of Commerce estimates that, as compared with the beginning of the century, the reduction has been at least 15 per cent.

Annual Report of Pittsburgh Plate Glass Company

Plans Outlined for Further Expansion

The annual report of the Chairman of the Board of Directors and the President of the Pittsburgh Plate Glass Company presented to the stockholders on March 11, 1929, contains so much information concerning the company's activities during the year 1928, and its plans for this year that it is printed below in full.

PITTSBURGH, Penna., March 11, 1929.

To the Stockholders of the Pittsburgh Plate Glass Company:

We submit the following report of the business of your Company for the year 1928:

The gross earnings for the year 1928 were $13,988,000.64. Deducting $4,311,633.55 for depreciation, obsolescence and depletion, $7,593.94 for federal income taxes paid in 1928, in excess of the amount reserved therefor, and $1,200,000 as a reserve for federal income taxes payable in 1929 leaves a net profit for 1928, of $8,468,773.15. This compares with net profit of $6,523,768.91 for the year 1927. Cash dividends paid in 1928 amounted to $4,037,301.50, and stock dividend, $4,923,900. Additions to Plant Investment aggregated $6,392,141.44, making a net increase in Plant Investment, after deducting depreciation, obsolescence and depletion, of $2,078,362.04. Appropriations for additions and improvements unexpended at January 1, 1929, amounted to $10,881,140.98. Since January 1, further appropriations aggregating $2,708,669.31 have been made.

The domestic consumption of plate glass again reached approximately 150,000,000 square feet, an increase over 1927 of about 25,000,000 square feet. This was largely the result of greater activity in the automobile industry.

Plate glass production last year was slightly in excess of 130,000,000 square feet, while the capacity of the domestic plants was about 150,000,000 square feet. Importations of foreign glass totaled approximately 16,000,000 square feet, which was a slight increase over 1927. Foreign glass was an important factor in the market, through its influence on both production and prices. Imported glass was regularly sold at less than the prices prevailing on the domestic product.

For more than five years the Tariff Commission had the plate glass industry under consideration, during which time it developed figures showing the costs of production in Europe and the United States. As a result of the report finally submitted by the Commission, President Coolidge, under date of January 17, 1929, issued a proclamation advancing by approximately four cents per square foot, the rates of duty fixed by the Fordney-McCumber Act. It is hoped that this action may result in a reduction of importations and a corresponding increase in domestic production. This would provide increased employment for many men, directly and indirectly.

Present indications are for a favorable demand during the current year, notwithstanding some evidence of a decrease in building activities. One new plant was placed in operation in the country last November, and a second and much larger plant is about completed. Two additional plants of large capacity are in course of erection, and at least one more is in contemplation. The domestic capacity will reach 180,000,000 square feet before the end of the year, and approximately 225,000,000 square feet in 1930. Overproduction is therefore a menace which promises severe competition and ultimately lower prices.

Warehouses for the distribution of our products were opened at Peoria, Illinois, and South Bend, Indiana, making a total of fifty-eight warehouses now in operation. Additional sites are being selected, and warehouses will be opened in due course.

Special products continue to make an important contribution to our volume and profits. *Vista Plate* (⅛" Polished Plate Glass) is growing in popularity and demand, for use in private dwelling houses, apartments, schools, hospitals and other institutions. Notable installations of *Tapestry* glass were made during the year. The sales of *Carrara* and *Frostex* glasses increased, and the market for these products is expanding.

For some time we have been developing a process for the drawing of sheet glass. We are now operating under this process two tanks at Clarksburg, West Virginia, and one at Mount Vernon, Ohio, which are producing regularly and commercially superior quality of flat sheet glass. Appropriations recently were made for a second tank at Mount Vernon, and the erection of a new plant at a suitable location in Oklahoma. When this program of expansion is completed, we shall be in position adequately to supply our warehouses and customers with high grade flat sheet glass of our own manufacture. Arrangements are being made for the installation of this process in the window glass producing countries of Europe.

The rebuilding and modernizing of the Ford City (Pennsylvania) plant at an expenditure of $5,500,000, begun a year ago, has been carried out satisfactorily, and is nearing completion. The new grinding and polishing unit will be put into operation during the month of June, 1929. The authorization of this improvement has been followed by a like one covering similar changes at the Crystal City (Missouri) plant. The work of rebuilding this unit is now well under way, and production by the new process is expected about the close of the year 1929.

Substantial additions have been made to our machine shops, where practically all of the machinery for these units is being built from designs created by our Engineering Department.

Tanks as used at Creighton for the production of plate glass have not yet been developed to the point where they will produce glass of satisfactory quality in the larger sizes. The new method of casting and annealing glass melted in pots, which was developed only recently by the Company, therefore will be used in the Ford City and Crystal City plants.

The improvements at both of these plants not only provide for an increase in production of polished plate glass of standard thicknesses, but for the manufacture of ⅛" polished plate glass, there being a large demand for this product by the manufacturers of laminated safety glass.

Thirty patents were issued to the Company in the year 1928. They relate for the most part to improvements in the manufacture of plate glass by the continuous tank process, continuous grinding and polishing, and the new process of casting and annealing glass made from pots.

The new dredge operating in the Allegheny River for the purpose of supplying local plants with grinding sand has completed the first full year of operation. While some difficulties were encountered, this department has demonstrated its value as a source of supply of this commodity.

Our Courcelles, Belgium, plate glass plant was operated throughout the year. Volume of production and sales, quality of product, and profits were satisfactory.

The Duplate Corporation, a joint interest of the Dupont Viscoloid Company and the Pittsburgh Plate Glass Company, recently moved into new factory buildings at Creighton, Pennsylvania, which with equipment, cost approximately $1,000,000. A year ago this Company started as a small department in temporary buildings, to produce a limited quantity of laminated safety glass known as *Duplate*. Demand for this product, by the automobile manufacturers, soon forced the company to go into production in excess of the facilities provided at that time. This required rapid expansion, and many difficulties were encountered. On the whole, this operation viewed as one of developing a new product, has been satisfactory. When properly manufactured, laminated safety glass has real merit. There is a growing demand for our product, which used throughout in automobiles, insures a large measure of safety in the event of collision. *Duplate* has been adopted by a number of leading automobile manufacturers as standard equipment in many models. With the facilities now provided, we look forward to a rapid growth of this business.

The Research Department has continued to carry out the Company's policy of developing new ideas and methods bearing on glass, production problems. Installations being made at this time at our various plants are the result of this endeavor.

In the Columbia Division, which includes our heavy chemical plant at Barberton, Ohio, where we manufacture soda ash and caustic soda with several by-products, and the limestone quarry

and cement plant at Fultonham near Zanesville, Ohio, many additions and improvements to plant and equipment have been made during the past year. These will increase productive capacity, reduce costs, and enable us to maintain the high standard of our chemical products. A modern research chemical laboratory was established at Barberton, in the same building that is used for our regular chemical laboratory operations. This, it is believed, will be of great value to our Barberton and Zanesville processes. The demand for our principal chemical products was the largest of any year since the consolidation.

We are pleased also to report the continued growth in the demand for our chemical by-products including calcium chloride, plant lime for soil fertilization, whiting and a purifier for steel.

The production and sale of *Columbia* Portland Cement was satisfactory as to cost of production and quality of product. *Columbia* is among the leading brands of Portland Cement. Its high standard was maintained, and sales were the highest yet reached, although not sufficient to warrant full capacity plant operation, as there is an overproduction of Portland Cement in this country. The prospects for the coming year are favorable, in both the chemical and cement departments.

The factories of the paint, varnish and lacquer division were operated at a uniformly satisfactory rate of output throughout the year. Production and sales in all lines of this division again showed material increases, and were the largest in the history of our business. The greatest increase was in sales of *Mimax* Lacquer to automobile manufacturers.

We acquired the entire capital stock of the Ditzler Color Company of Detroit, doing exclusively a lacquer business and enjoying an enviable reputation for automobile finishes. This gave us an old reliable concern, with a new plant, located in the center of the automobile manufacturing district, and a well established business with both automobile manufacturers and refinishing shops. The product is known under the trade name *Ditzlac*. In order to realize the full value of the business, this subsidiary will be continued under its present name and management.

There was a gratifying increase in the sale of our high grade paint and varnish products particularly *Sun-Proof* paint for exterior house painting, *Velumina* flat wall paint for interior painting, *Lavax*, a new type of finishing material, and *Waterspar* varnish, lacquer and enamel for household use. A *Quick Drying Enamel* has been added to our *Waterspar* line, to meet the demand created by the introduction of lacquer for household use. *Merko*, for the treatment of seed corn, met with considerable favor and the sales of this fungicide increased.

The establishment some years ago of a research laboratory devoted wholly to the development of products for the paint and varnish division, has enabled us to hold a leading position in the development of new and profitable products.

There were no important price changes in this division in 1928. The policy of the Company in establishing uniform prices for its paint products to be maintained over long periods and to eliminate speculation has proved to be beneficial. With our large warehouse distribution, we are in a position to give our trade prompt service, which facilitates operation with small stocks and gives a quick turnover. There has been a tendency recently toward advancement in raw material markets, and special attention is being given to manufacturing economies in order to maintain the lowest possible prices for the high quality of products manufactured. The outlook for 1929 is for a larger volume of business in all lines of the paint, varnish and lacquer division.

There were moderate increases in the volume of our brush business and the profits resulting therefrom.

Group life, health and accident insurance of employes, payment of pensions to the aged and disabled, and bonuses have been continued.

As stockholders you have cause to be satisfied with the results of the year's operations, and especially with the progress made by your Company during the past year in the development of improved processes of manufacture and methods of distribution, due largely to the tireless energy, the competency and loyalty of its departmental officers, managers, engineers, superintendents and their assistants, which are recognized and appreciated, and here recorded by the directors and executive officers of the Company.

W. L. CLAUSE,
Chairman of the Board of Directors.
H. S. WHERRETT,
President.

STATEMENT OF ASSETS AND LIABILITIES
DECEMBER 31, 1928

ASSETS		ASSETS	LIABILITIES
Investment		$50,131,756.25	
Merchandise	$10,842,428.11		
Material and working accounts	7,383,957.41		
Bills and accounts receivable...	10,600,338.41		
Federal Government and other securities	14,358,257.15		
Cash	2,807,088.35		
Quick assets		45,992,069.43	
LIABILITIES			
Capital stock authorized....	$65,600,000.00		
Less unissued capital stock....	10,836,900.00		
			$54,163,100.00
SUNDRY CREDITS:			
Bills payable	None		
Accounts payable—Current..	$4,087,201.02		
			4,087,201.02
General insurance reserve....			1,294,233.85
Reserve for inventory deflation, obsolescence and other contingencies			2,635,509.93
Reserve for estimated Federal income taxes payable in 1929			1,200,000.00
PROFIT AND LOSS			
Surplus January 1, 1928... ..	$33,276,209.23		
Earnings, year 1928.....	13,988,000.64		
	$47,224,209.87		
LESS:			
Depreciation, obsolescence and depletion.	$4,311,633.55		
Cash dividends 1928.	4,037,301.50		
Stock dividends 1928.	4,923,900.00		
Federal income taxes paid year 1928 in excess of reserve.	7,593.94		
Reserve for Federal income taxes payable year 1929..	1,200,000.00		
	14,480,428.99		
Balance in surplus December 31, 1928.....			32,743,780.88
		$96,123,825.68	$96,123,825.68

Professor Turner of Sheffield Visiting America

Professor W. E. S. Turner, Head of the School of Glass Technology at The University, Sheffield, England, and Honorary Secretary of the Society of Glass Technology as well as editor of the Society's quarterly *Journal*, arrived in Boston, March 19, via the Cunard line and after a short visit with relatives in Massachusetts, a brief stop in Connecticut and a few days spent in calling on friends in New York, began a trip through several of the glass manufacturing districts that will occupy his time until well into the month of May. His visit will bring him into personal contact again with the host of friends he has in this country who warmly appreciate the substantial benefits his unparalleled researches and those of his associates, in glass, are continually bringing to the industry throughout the world.

Ford Motor Company's Glass Output

During the year 1928 the Ford Motor Company is reputed to have manufactured 14,155,507 square feet of plate glass. Of this 5,399,773 square feet were made in the River Rouge plant, 2,240,560 square feet at the Twin Cities plant, all by the continuous process, and 6,515,208 square feet at Glassmere, Pa., by the pot melting process. In the report given above the Highland Park plant is not mentioned.

The Ford Motor Company recently announced that owing to the consolidation of Dearborn and Fordson, Michigan, the name of the Fordson plant has been changed to Rouge Plant, Dearborn, Michigan. The experimental laboratory should now be addressed as "Ford Motor Company, Engineering Laboratory," Dearborn, Michigan.

Incandescent Lamp Sales

Sales of incandescent lamps in the United States during 1928 were approximately 319,000,000 large size and 240,000,000 small lamps, according to a review of the electrical industry for the year by John Liston of the General Electric Company. This is an increase of about 1,500,000 in the large sizes over 1927, and 20,500,000 in the small sizes over the previous year.

"Large lamp prices are now 49 per cent and miniature lamp prices are 48 per cent of the corresponding 1914 figures."

Pittsburgh Safety Glass Company Denies Infringement of Laminated Glass Patent

The bill of complaint filed December 31, 1928, in the United States District Court at Pittsburgh, Pa., by the Triplex Safety Glass Company of North America alleging infringement of U. S. Patent No. 1,182,739, issued May 9, 1916, to Edouard Benedictus, and asking for an accounting from the alleged infringer, the Pittsburgh Safety Glass Company, was answered by the latter in a reply filed in the Court March 4, 1929.

J. C. Bradley, C. H. Biersterfeld, and Marshall A. Christy of Pittsburgh are representing latter company in the case.

The defendant denies that the patent in dispute was lawfully issued to Benedictus and avers that prior to the date of his application for the patent the improvements it describes had been known, used and patented in this country and cites several earlier patents to prove his assertions.

A copy of his answer follows:

DEFENDANT'S ANSWER

1. Defendant admits the corporate existence of the Plaintiff as averred in Paragraph First of the Bill of Complaint and it admits itself to be a corporation of the State of Delaware, having its principal office and regular and established place of business at Pittsburgh, Pennsylvania, but it denies that it has committed any act of infringement within the Western District of Pennsylvania or elsewhere.

2. With respect to the averments of Paragraphs Third and Fourth of the Bill of Complaint, Defendant admits the issue of Letters Patent therein named, No. 1,182,739, to Edouard Benedictus, but it denies that the said Letters Patent were lawfully issued, as well as that there was thereby granted to the said Edouard Benedictus, his heirs, legal representatives or assigns, any exclusive right or liberty, and it denies all the other averments contained in said Paragraphs Third and Fourth.

3. As to the averments of Paragraph Fifth of the Bill of Complaint, Defendant is without knowledge.

4. As to the averments of Paragraph Sixth of the Bill of Complaint, Defendant is without knowledge.

5. Whether or not the Plaintiff has marked strengthened glass manufactured and sold by it, and alleged to embody the alleged improvements of the said Letters Patent as "Patented," as averred in Paragraph Seventh of the Bill of Complaint, Defendant is without knowledge. Defendant admits that prior to the filing of the Bill of Complaint it was notified of the said Letters Patent and of its alleged infringement thereof, but it denies that it has committed any infringing acts either before or after such notice.

6. Defendant denies that at any time it has made or sold, is now making or selling, or intends to make or sell any strengthened glass embodying any of the alleged improvements purporting to be described and claimed in the said Letters Patent, within the Western District of Pennsylvania or elsewhere, and it denies each and all of the averments of Paragraph Eighth of the Bill of Complaint.

7. Defendant denies that Edouard Benedictus, in said Bill of Complaint named, was the true, original and first inventor of any of the alleged improvements purporting to be set forth in the said Letters Patent No. 1,182,739, or of any material or substantial part thereof; on the contrary, Defendant avers the fact to be, that prior to the pretended invention thereof by the said Benedictus, and for more than two years prior to the date of his application for the said Letters Patent, the said alleged improvements, in all material and substantial parts, had been known and used in this country, and had been patented and described in printed publications in this and other countries, as is disclosed in and by the following:

UNITED STATES LETTERS PATENT

No. 346,864, dated August 3rd, 1886, to Read.
No. 610,861, dated September 13th, 1898, to Goodwin.
No. 765,275, dated July 19th, 1904, to Fields.
No. 830,398, dated September 4th, 1906, to Wood.

ENGLISH LETTERS PATENT

No. 3250 of 1873, to Holyoake.
No. 5080 of 1884, to Cunliffe.
No. 15303 of 1884, to Fultickes.
No. 17126 of 1900, to Hofer.
No. 9972 of 1905, to Wood.

FRENCH LETTERS PATENT

No. 356,076 of 1905, to Wood.
No. 404,795 of 1909, to Souiier.

8. Defendant, in further denial of invention by the said Benedictus of any of the said alleged improvements, avers that in view of the state of the art as it existed at and prior to his application for the said Letters Patent, and at and prior to his pretended invention thereof, the said alleged improvements did not, nor did any of them, constitute, contain or embody any patentable subject-matter. In proof of such prior state of the art, Defendant will refer, among other matters to the prior Letters Patent listed in the last preceding paragraph.

9. Defendant, further answering avers that the description or specification filed by the said Benedictus in the Patent Office, in making his application for the said Letters Patent, was defective and misleading and did not set forth the manner and process of making, constructing, compounding and using his said alleged improvements in sufficiently full, clear and exact terms as to enable a person skilled in the art to which they appertain to make, construct, compound and use the same.

10. Defendant, further answering, avers that for the purpose of deceiving the public, the description or specification filed by the said Benedictus in the Patent Office, in making his application for the said Letters Patent, was made to contain less than the whole truth relative to his pretended invention or discovery.

12. Defendant denies the equity of the said Bill of Complaint; it denies that the Plaintiff has any right to any injunction, preliminary or perpetual, or to any accounting of damages, or profits, or to the costs of this suit, or to any relief whatever against this Defendant; and it further denies that the said Bill of Complaint states any good cause for action. All of which matters and things Defendant; is ready to prove and maintain as this Honorable Court shall direct, and in humbly prays that it be hence dismissed with its reasonable costs and charges in this behalf most wrongfully sustained.

Car Distribution Nearly 100% Perfect

This distribution of the freight equipment of the Class I railways in 1928 was 99.7 per cent perfect, according to an analysis of reports showing the average daily freight car surplus and shortage. This establishes a new record in efficient distribution of equipment. Complaints of shortage of freight cars have practically been eliminated.

Final reports show that with total revenue car loadings for 1928 of 51,576,731 cars, or a daily average of 140,920 cars, the average daily shortage amounted to only 42 cars, or within three hundredths of one per cent perfect.

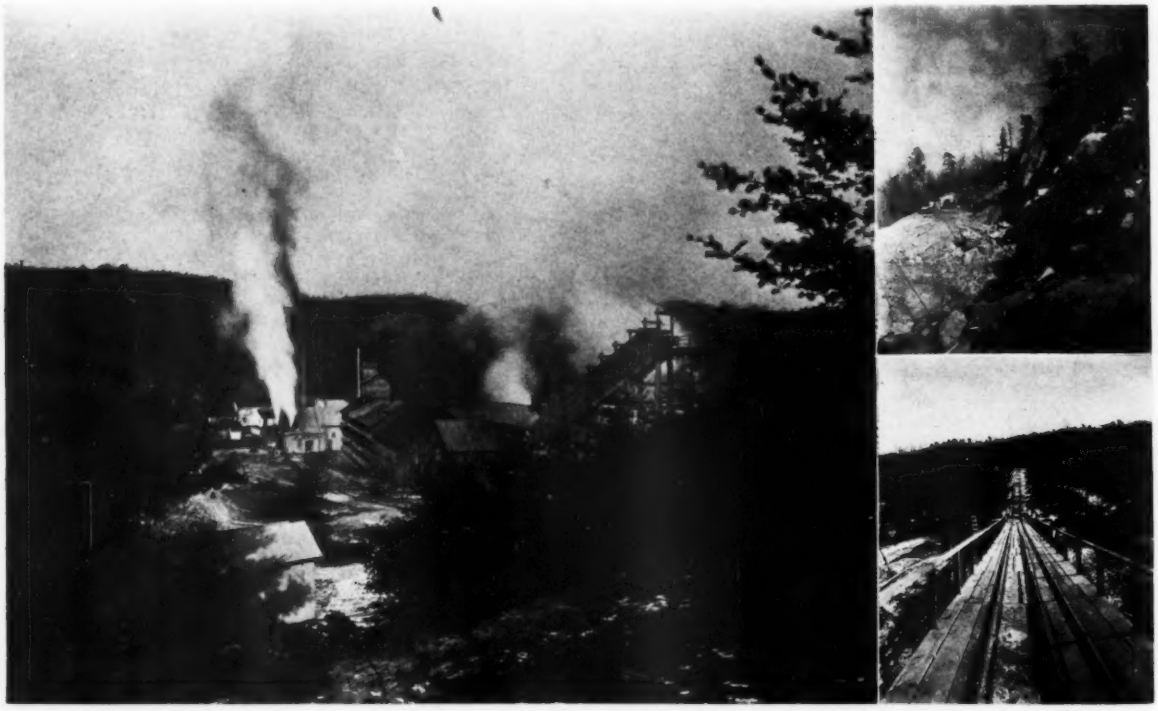
Surplus and shortage reports are issued four times a month. Of the 48 reports covering last year no car shortages whatever existed in 20 of the reporting periods. For seven consecutive periods, namely, from the second week in March to the first of May, there was not a single car shortage on any of the Class I railroad. This high peak of efficient distribution can be more clearly understood when compared with conditions in the past.

In the year 1920, for example—the year when the carriers were returned to private ownership, following the Federal control period—there was an average daily shortage of 81,592 freight cars. In 1921, largely because of the slump in traffic, the average daily freight car shortage fell to 1,454 cars, but in 1922, it rose to 47,882 cars.

Despite heavier traffic in 1923, the improved distribution of cars cut the average daily shortage down to 29,216. Since that year car shortages have been practically eliminated, the average in 1924 standing at 1,047; in 1925 at 443; in 1926 at 287; in 1927 at 170; and in 1928 at 42.—*The Atlantic*, published by The Atlantic State Shippers Advisory Board.

Will Add New Unit to Glass Sand Plant

IN the December 1928 issue the first report was given of the organization and incorporation of the Eastern Silica & Chemical Company of Winchester, Va. for the purpose of taking over the old Winchester Glass Sand Corporation plant near Gore, Frederick County, Va. and improving, enlarging, and operating the plant to produce glass sand of the best quality. The sand comprising the deposit according to the analysis published in detail in the above-mentioned article is shown to be of excellent glassmaking quality and suitable also for use in various other industries including porcelain wares, soaps, talcum powders, steel, etc. The improvements announced as planned at that time have been practically completed and the plant is now operating on full time with about twenty-five men employed in the work of quarrying and preparing the sand for shipment, principally to glass factories throughout the Eastern states.



QUARRY AND PLANT OF THE EASTERN SILICA & CHEMICAL COMPANY, WINCHESTER, VIRGINIA

It is now possible to show the accompanying illustrations of the works, which have been equipped with a cable railway and tram cars in place of the sluice formerly used for delivering the rock from the quarry to the crushing plant, and in which the other important improvements referred to have already been made.

Announcement was made on March 13 that the production and sale of glass sand has been going on so satisfactorily that arrangements will be made at once for the installation of an additional production unit which will practically double the capacity of the works and result in a substantial increase in the number of workers employed. Dwelling houses for the employes who have come from other sections to work at the mines and crushing plant will also be erected. The existing plant has a capacity of about 400 tons of glass sand every twenty-four hours.

The president of the Eastern Silica and Chemical Company is John F. Penrose, formerly of New York, a successful developer of Mexican oil properties and now located at the sand company's headquarters at Winchester, Va. Edward V. Pechin of Baltimore is vice-president and D. H. Sencindiver of Winchester, secretary and treasurer. The board of directors includes the above three officers, Herbert S. Larrick, an attorney and president of the Commercial and Savings Bank of Winchester, and Allen I. Cole, chairman of the board of directors of the Pennsylvania Exchange Bank of New York. George W. Hohannes, formerly general manager of the Berkeley Springs Glass Sand Company and until recently in charge of the operation of that property after its absorption into the Pennsylvania Glass Sand Corporation, is general manager, and active in both production and sales work.

New Glass Edging Machine

A patent has been applied for by Joseph Cappelman on a machine especially adapted for edging glass and said to be capable of putting the sheets through at a uniform rate of speed and with uniform pressure applied to the sheet through its length. The edging elements of this device are interchangeable so that the plates may be roughed, smoothed or polished on the one machine. The inventor states that the machine may be fed by hand or automatically. It may be arranged to edge either straight or curved glass such as the lower edge of a windshield if the curve is part of a true circle. When edging curved glass, however, the machine can be fed only by hand. The machine works on the whole length of the sheet's edge at one time. Two or more sheets, it is said, may be worked at once, according to the size of the machine. When the glass is fed by hand and the rack in which the glass sets is level, the sheet will be exactly square when finished, even if not cut square. The glass can be held in the rack by two small rubber-lined clamps for any length of time and provision is made to prevent it from being ground smaller than the size desired. It is claimed that the machine will edge safety glass without causing any separation between the sheet and filler.

Provision is made to keep the chain and all other working parts covered and protected when cast iron blocks and wet emery is being used.

A water spray at the end of the machine washes the emery into the container where it may be gathered, washed and used over again.

When desired the entire machine can be covered with sheet iron or wood for safety reasons, leaving only the grinding groove exposed.

The Glass World and What It Is Doing

News of the Industry

Light's Golden Jubilee Announced

This year brings the fiftieth anniversary, October 21, of Thomas Edison's first practical incandescent lamp, the very cornerstone upon which the great electrical industry has raised itself. It is proposed to celebrate this fiftieth birthday of the incandescent lamp with a golden jubilee. It will be a celebration exclusive to no one company or industry nor will it be limited to any single nation. It is upon the people of the world, upon a grateful people, that the blessings of Edison have been showered. The inception of the idea of holding such a jubilee took place on Edison's eighty-second birthday at a luncheon of the Edison Pioneers. It was resolved to organize a committee to form an organization for planning, directing and co-ordinating the many events and activities that will be involved in the celebration. A great series of events is planned to take place relatively early, leading up to a tremendous climax on October 21 at Atlantic City which will be "the night of light." The jubilee is to have the unstinted support of Henry Ford, the Edison Pioneers and other close friends of Thomas Edison. As an example of the progress made in lighting engineering the announcement of the jubilee gives an illustration showing that the cost of lighting a room with a 100-watt Mazda lamp for 1,000 hours at seven cents per kilowatt-hour for current charge, is $7.35. The cost of lighting a room to the same degree of brightness with replicas of the first commercial incandescent lamp would be $68.75 and the cost of lighting it just as brightly with candles by replacing the candles as they were consumed would make a lighting bill at the end of 1,000 hours amounting to $1,500.

The headquarters of the jubilee organization is at Room 2650, Graybar Building, 420 Lexington Avenue, New York.

New Decoration on China and Glass

In viewing the glass and china section of the Exhibition of Modern Contemporary Industrial Art held recently at Macy's department store, New York City, it was noted that the use of a material resembling silver or platinum was resorted to in much of the ware on display. This metallic decoration formed a most pleasing contrast to the white or ivory of the china body and also to the colors in a decorative motif on both glass and china, and it would not be surprising if the use of such metallic decoration would gain favor.

The important feature of this decoration is that it is absolutely non-tarnishable; it does not contain silver, but appears to be a mixture of gold and platinum. An all platinum decoration is obviously too expensive to use on medium priced table ware. The use of silver as a decoration has always met with objections because of its being subject to tarnishing oxidation with consequent loss of color and lustre.

The new decoration is obtained with liquid bright white gold. Precious metal decorations have always been popular and this revival of a decoration of pleasing color, free from the tendency to tarnish, gives promise of becoming popular.

Election of Officers, Society of Glass Technology

At the twelfth annual meeting of the Society of Glass Technology in England on April 17, 1929, the election of officers for the ensuing year will take place. The following nominations have been made by the Council and not opposed:

For President: Herbert Webb. Vice-presidents: E. A. Coad-Pryor, B.A.; C. J. Peddle, M.B.E., D.Sc., F.I.C.

Ordinary Members of Council: *F. F. S. Bryson, M.B.E., M.A., B.Sc., F.Inst.P.; S. English, D.Sc., F.I.C.; F.Inst.P.; H. W. Howes, M.Sc.Tech.; E. J. Jobling-Purser; V. H. Stott, M.Sc.; Christopher Wilson.

*Nominated in place of Mr. Herbert Webb whose term of office as an ordinary member of Council would not normally have expired until 1931.

Hon. Treasurers: General—Joseph Connolly. American—F. C. Flint, B.S.

Hon. Secretary: Prof. W. E. S. Turner, O.B.E., D.Sc., F.Inst.P.

Auditors: To be nominated at the meeting.

Favorable Reports from Clifton Springs

The innumerable friends of H. L. Dixon, president of H. L. Dixon Company have been much gratified and relieved to hear reports from Clifton Springs, N. Y., that he continues to improve in health. All look forward in pleasant anticipation to the day when he will be able to resume his normal activities.

S. R. Scholes Now With Fostoria Glass

S. R. Scholes, who has been employed for the past eight years at the Federal Glass Company of Columbus, Ohio, has accepted the position of Technical Director of the Fostoria Glass Company, Moundsville, W. Va., and is starting in his new field of work on April 1.

Frank O. Brown, who was Assistant Chemist under the late A. R. Payne, is now Chief Chemist.

Alanson B. Houghton Leaves London

Reports from England state that Alanson B. Houghton who has been the United States Ambassador to the Court of St. James, London, since April, 1925 has relinquished his office and left that city for a three weeks' stay at Badan-Baden before sailing for the United States. The Ambassador was the guest of honor at a dinner given by the Pilgrim Society of London on March 26.

In the daily press General Dawes and Dwight Davis have both been suggested as possible successors to Mr. Houghton.

British Ceramists Coming

A party of about one hundred of the members of the Ceramic Society, Great Britain, whose proposed tour through the ceramic districts of this country was announced some time ago, will arrive in this country late in April and after visiting various plants in the East will proceed to the Middle Western districts where an elaborate program of visits has been arranged. No organized body of glass men is included in the party, though doubtless some of the individual members will be investigating conditions among the glass factories.

The Twelfth Chemicals Exposition

The twelfth exposition of Chemical Industries will be held at the Grand Central Palace, New York, during the week of May 6 to 11. The exposition draws together chemists, engineers, manufacturers and others interested from forty industries, including glass manufacturing, which are dependent in their operations upon a chemical change in the nature of the material or are under chemical control.

It is stated that the American chemical industry has grown to be the largest in the world with an annual production of $2,278,000,000. The exposition offers to the interested industries, through several hundred exhibits, an excellent opportunity for obtaining knowledge of the latest equipment, apparatus, chemicals and supplies used in the manufacture of their products.

Classification of Colored Glass Balls

The Atlantic Importing Corporation of Philadelphia recently obtained a ruling from the Customs Court on the classification of imported colored glass balls. A duty had been imposed at 60% ad valorem under paragraphs 218, Act of 1922, as glass illuminating articles. The judge found that these balls are not prisms and do not perform the same service as chimneys,

globes or shades mentioned in the illuminating glass provision in paragraph 218, and ordered that the duty should have been assessed at only 55% ad valorem.

Plate Glass Production

The production of polished plate glass for the month of February, 1929, as shown by the monthly compilation of Secretary P. A. Hughes of the Plate Glass Manufacturers of America, was 11,289,396 square feet, which compares with 11,425,575 square feet produced in the preceding month, January, 1929 and with February, 1928, 10,689,184 square feet. The January production was about three-quarters of a million square feet over that of December, 1928, and compares with the January, 1928, production of 8,825,363 square feet.

No Change in Import Duty on Sand

Rumors were in circulation in New York early in March to the effect that the Treasury Department had again placed a duty on glass sand imported from Belgium and other countries. Investigation, however, proved that there was no foundation for this report and that the Treasury Department's decision published January 3, 1929, that Belgian and other similar sand used in the manufacturing of glass be admitted free of duty as sand under the provisions of paragraph 1675 of the tariff act of 1922, is the latest decision and still in force.

President Butterworth Lectures on Glass

Walter Butterworth, President of the Society of Glass Technology, delivered a series of lectures on "Artistic Glass Through the Centuries" during the month of February at the art gallery of the city of Manchester, England. The first lecture on February 12 was on ancient glass, including Egyptian, Phonecian, Roman and Eastern glass. The second lecture on February 19 was devoted to Venetian and stained glass. The third to modern glass, taking in Germany, France, Spain, Netherlands, England, Scandanavia and the United States. He also discussed present day tendencies in artistic glass.

Window Glass Tariff Report

The tariff commission on March 19 stated that the final report covering its findings in the investigation of the cost of producing domestic and foreign window glass has been approved and directions given that it be sent to President Hoover. However, considerable mechanical work will be involved in preparing the report which will consume some time so that it may not be submitted immediately. The members of the commission, it is stated, have completed their part of the work.

Ford City Plant Will Soon Begin Operations

The Pittsburgh Plate Glass Company's new grinding and polishing plant at Works No. 4, Ford City, Pa., which is being completely replaced with a grinding and polishing unit of the continuous type such as now used at the Creighton plant will be ready for operation in June, according to W. A. Reynolds of the Ford City plant. The reconstruction has involved the expenditure of several millions of dollars. The company's sheet glass plant at Mt. Vernon, O., is resuming operations with one tank and appropriations have been made for a second tank which will enlarge the plant capacity to twice its present size.

South Dakota Visions Glass Factories

According to Louis N. Crill, Secretary of Agriculture for South Dakota, that state is fortunate in having nearly all essential materials for the manufacture of glass products. Gas mains to bring natural gas to all Black Hill points have been laid. Silica sand is said to be found in abundance in the Black Hills and the white quartz at Keystone is said to be especially valuable in glassmaking. Limestone deposits are plentiful. Lead is found at various points. Marble dust can be obtained at marble quarries near Rapid City. Manganese is said to be available in the sand beds of the Missouri River. Lepidolite in large quantities is said to have been discovered at the Ingersoll mine near Keystone. Large deposits of feldspar are also claimed. Deposits of magnesia are found in the Rosebud district.

Trade Activities

The Pittsburgh Plate Glass Company early in March announced the removal of its general offices to the Grant Building, Fourth Avenue and Grant Street, Pittsburgh, Pa.

Glass & Onyx Products Company, Kokomo, Ind., has been incorporated to merchandise articles made of those materials The incorporators are Don P. Strode, Verl S. Wiley and Thelma M. McGrail.

Robert Miller of the Pittsburgh Plate Glass Company's engineering department at Creighton, Pa., recently gave a talk to the Tarentum Kiwanis Club on the history and present development of the industry.

The Bienenfeld Glass Works are reported to have plans for a one-story glass warehouse, 100 x 180 feet in size, to be erected at Covert Street and Wyckoff Avenue, Ridgewood, N. Y., at an estimated cost of $80,000. A. Goldstein, 26 Court Street, Brooklyn, N. Y., is architect.

The Binswanger Plate Glass Company, Houston, Texas, are reported to have awarded a contract for a two-story, 90 x 130 foot warehouse for glass to T. B. Hubbard of that city at an estimate cost of $75,000.

The Brown Instrument Company, Philadelphia, announces the appointment of two vice-presidents as follows: Charles H. Kerr, vice-president and general manager; George W. Keller, vice-president and general sales manager.

The Metropolitan Life Insurance Company's Policy Holders' Service Bureau has issued a report which presents in detail cases in which fact finding and fact interpretation which the company advocates in manufacturing plants, has been used advantageously to stabilize working forces and employment programs.

The Safetee Glass Company, State Road, Wissinoming, Philadelphia, Pa., has purchased the factory of H. G. Fetteroff & Company at Stanton Avenue and Louden Street, which includes a plot of land approximately 185 feet by 315 feet in size. It was assessed at $180,000 and it is reported had been held at $350,000.

The Hazel-Atlas Glass Company, Wheeling, W. Va., has entered into a contract with the Hutter Construction Company of Fond du Lac, Wisconsin, for the building of a four-story warehouse of brick and concrete at Washington, Pa. An automatic sprinkler system will be installed. The building will have approximately 88,000 square feet of floor space. This building will adjoin the Hazel No. 1 plant.

The Owens Bottle Company recently became the defendant in a patent infringement suit filed in the Federal Court at Toledo by Michael H. Kyriak of the same city. The patent involved was granted to Maxim Nevin, October 7, 1919 on an "improvement in the process of manufacturing bottles." The inventor died in 1924 and equal shares in the patent rights were left to his wife and sister. In 1928, according to a report, these rights were all transferred to the plaintiff who in the meantime had been married to Mrs. Nevin.

The Triplex Safety Glass Company of North America, Clifton, N. J., have formed a new company called The Triplex Safety Glass Company of Newark, New Jersey, Inc., to take over the New Jersey sales division and handle the company's products for central and northern New Jersey. Robert Burns, Jr., formerly in charge of the sales division will be at the head of the new organization. This is said to be in line with the policy of the parent company at Clifton of concentrating its energies there on the manufacturing branch of the business.

The Triplex Safety Glass Company of North America, it is reported, arranged for a meeting of stockholders on March 26, to act on proposed amendments to the certificate of incorporation to admit an adjustment with Triplex Safety Glass Company, Ltd., of London, whereby the American company will obtain exclusive right to transact its Triplex glass business in South America. It is also proposed to simplify the company's financial structure by eliminating its founder shares and the termination of all royalty payments to the English company.

Daniel Taylor, of Pittsburgh, whose temporary address is Coshocton, Pa., and who was recently instrumental in disposing by private sale of the Marion plant of Macbeth-Evans Glass Company at Marion, Ind. on a basis satisfactory to both buyer and seller, has now announced that he is, as property manager, offering for sale the plant of the Coshocton Glass Corporation, Coshocton, O. This plant is located on the main line of the Pennsylvania Railroad Company, Wheeling and Lake Erie Railway, Toledo and Marietta Division of the Pennsylvania lines.

The General Color Products Company will build a new building adjoining its plant at 2108 North Natchez Avenue, Chicago, according to announcement by C. C. Leigh, president of the company. The new plant will be of one story, steel frame construction, one story high, with a monitor. The dimensions are 80 by 180 feet and the cost is announced as $50,000. Thirty-five tons of structural steel will be used. The Austin Company, the architects and builders, expect to have the building ready for occupancy early in May. The Austin Company previously designed and built factory structures for the General Color Products Company. The Company manufactures colors for the glass, pottery and metal trades under the trade name "Eternleigh."

Recent Deaths

C. M. Hollingsworth

Clarence M. Hollingsworth, of Steubenville, O., vice-president of the Ohio Valley Clay Company, died suddenly at Montreal, Quebec, on March 18. He had been connected with that company for over 26 years.

John Klumpp, Sr.

John Klumpp, Sr., head of the works of the Macbeth-Evans Glass Company at Elwood, Ind., died on March 11 in that city, following a stroke suffered on March 8. He had been in the glass business for over half a century, more than half of it with the Macbeth-Evans organization.

Inquiries Received

454. We should like to receive a complete set of descriptive literature in triplicate with prices and discounts for resale covering equipment suitable for polishing mirror glass to prepare it for resilvering. Equipment that is not too expensive or elaborate would be preferred.

Glass Stock Quotations

Reported by Moore, Leonard & Lynch, Union Bank Building, Pittsburgh, Pa.

PITTSBURGH STOCK EXCHANGE, MARCH 19, 1929

	Bid	Asked	Last
American Window Glass Com.	..	..	..
American Window Glass Pfd.	..	..	87
American Window Glass Mch.			
Common	25	30	29
Pfd. Cumulative	..	..	48
Pittsburgh Plate Glass (New)	..	..	70
Standard Plate Glass:			
Common	5⅞	..	5
Pfd. Cumulative	..	..	18¼
Prior Pfd.	..	..	31
United States Glass	13¾	14½	14

TOLEDO, O., MARCH 20, 1929

	Bid	Asked	Last
Owens Bottle Pfd.	..	..	..
Libbey-Owens Sheet Glass Com.	..	..	..
Libbey-Owens Pfd.	115	..	116

WHEELING STOCK EXCHANGE, MARCH 21, 1929

	Bid	Asked	Last
Hazel-Atlas	103	104	104½
Imperial	..	38	72
Fostoria	200	..	200
Central	..	55	55
Jefferson Pfd.	..	..	96

What the World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C.

Philippine Islands—36566, Cheap glassware.

Germany—36886, Colored and white glassware and glassware for light fixtures.

Domestic—36660, Pressed, blown and decorative low priced glassware.

READERS' WANTS AND OFFERS

POSITION AS MANAGER WANTED

Can handle all kinds of Continuous and Day Tank and Pot Furnaces. All kinds of fuel and make all kinds of glass for Table Ware, Pressed or Blown, Illuminating Ware, Bottles, hand or machine, and Glass Containers. Address, SW-6, care THE GLASS INDUSTRY, 50 Church St., New York.

EUROPEAN REPRESENTATIVE AVAILABLE

German Engineer, with wide experience in glass machinery and equipment, and with good connections, wishes to represent a first-class American firm for Europe. Address, O-4, care THE GLASS INDUSTRY, 50 Church St., New York.

FOURCAULT WINDOW GLASS PLANT FOR SALE

Equipped with 8 Fourcault Process sheet drawing machines, latest type of batch storage and handling facilities. Designed and constructed by the Simplex Engineering Company. Furnaces exact duplicates of ones in successful operation in the plant of the Blackford Window Glass Company at Vincennes, Indiana. Ample natural gas available for several years at average price of 25c per 1000 cu. ft.

Plant was operated for only a few months. Is in excellent condition and can be made ready for operation at small cost. Close proximity of other Fourcault Process plants makes plenty of experienced labor available. Can be bought cheap and on reasonable terms. Address Carl L. Hornor, Clarksburg, W. Va.

FOR SALE—COSHOCTON GLASS PLANT

The undersigned is authorized to consider offers for immediate purchase of all real estate including building and complete glass-making equipment in the three factory units comprising the plant of the Coshocton Glass Corporation, Coshocton, Ohio. This glass works consists of three units with 25, 35 and 50 ton tanks, respectively, one of them equipped for complete automatic operation.

The equipment includes 3 Miller feeders, more than a dozen O'Neill machines, 9 gas producers including three Chapman automatic type and two Wellman type. Six Amsler-Morton automatic lehrs, a number of old type lehrs, several modern lehrs which were installed and never used and one complete automatic lehr which has never been set up, batch storage and handling equipment.

The plant is equipped with a complete electric power plant for operating all machinery and also with steam boilers.

A complete sprinkler system has been installed throughout. City water system supplies water, fuel costs are reasonable, the labor situation is very advantageous for the manufacturer.

The plant will be sold as a whole or the three units disposed of individually.

Prospective purchasers will kindly make appointment by wire, telephone, or letter for inspection of property to be sold. Detailed information covering foundations, construction of buildings, machinery and equipment, advantages of location, labor market, railroad facilities, etc., will be submitted.

For more details, descriptive folders, etc., address DANIEL TAYLOR, Property Manager, Coshocton, Ohio.

Current Prices of Glass-Making Materials

March 20, 1929

Quotations furnished by various producers, manufacturers and dealers.

		Carlots	Less Carlots
Acid			
Citric (dom.)	lb.	.46	.46
Hydrochloric (HCl) 20° tanks, per 100 lb.		..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.16	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	5.75
Sulphuric (H_2SO_4) 66° tank cars	ton	15.50	..
Tartaric	lb.	..	.38
Alcohol, denatured	gal.	..	.52
Aluminum hydrate ($Al(OH)_3$)	lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3)	lb	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.21-.22
Ammonia water (NH_4OH) 26° drums	lb.	.03	.03¼
Antimony, metallic (Sb)	lb.	..	.09⅝
Antimony oxide (Sb_2O_3)	lb.	..	.12-.14
Antimony sulphide (Sb_2S_3)	lb	..	.14
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.05
Barium carbonate ($BaCO_3$)			
Precipitated	ton	57.50-59.50	60.00-61.50
Natural, powdered, imported	ton	45.00	50.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	.04¾-.05½
Barium nitrate ($Ba(NO_3)_2$)	lb.	.08¼	.08½
Barium selenite ($BaSeO_3$)	lb.	..	..
Barium sulphate, in bags	ton	28.00-35.00	..
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point,	ton		16.00
Bone ash	carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	.02½-.02¾	.02¾-.03¾
Boric acid (H_3BO_3)	lb.	.05½-.05¾	.06-.07
Refined	lb	.05½-.05¾	.06-.07
Cadmium sulphide (CdS)—			
Red	lb	..	1.20
Orange	lb.	..	1.00-1.25
Yellow	lb.	..	1.20-1.40
Chromium oxide (Cr_2O_3)	lb.	.24	.25
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.25-.30
Black prepared	lb.	..	.30
Cryolite ($Na_3Al\ F_6$) Natural Greenland Kryolith)	lb.	.09	.10-.10½
Artificial or Chemical	lb.		.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.15-1.20
Feldspar—			
100 mesh	ton	11.00-20.00	15.50-22.00
80 mesh	ton	11.00-11.75	14.50
40 mesh	ton	11.00	13.50
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Formaldehyde	lb.	..	.09½
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.03¼-.03½
Black (FeO)	lb.	.03½	..
Kaolin (f.o.b. mine)	ton	9.00	..
English, lump, f.o.b. New York	ton	14.50-25.00	24.50-30.00
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb.	10.00	.11
Litharge (PbO)	lb.	.09	.10
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	11.50-12.50	..
Burnt (CaO) ground, in bulk	ton	8.00	..
Burnt, ground, in paper sacks	ton	10.00-11.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15-2.25	2.30-2.60
Limestone ($CaCO_3$)		2.00-2.50	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.06	.07
light (in bbls.)	lb.	..	.23
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.07
Manganese 85% (MnO_2)	lb.	.04	.04½
Nickel oxide (Ni_2O_3), black—			
for nickel content	lb.	..	.35
Nickel monoxide (NiO), green—			
for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	23.00-29.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.09	.09¾
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06½	.07
Hydrated 80-85%	lb.	.05¾	.06¼
Potassium chromate (K_2CrO_4)	lb.	..	.23-.32
Potassium hydrate (KOH) (caustic potash)	lb.	.07⅛	.08
Potassium nitrate (KNO_3) (gran.)	lb.	..	.05⅞-.06
Potassium permanganate ($KMnO_4$)	lb.	.16	.16½
Powdered blue	lb.	..	.24-.26
Rochelle salts, bbls.	lb.	..	.23
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb.	..	1.90-2.00
Silver nitrate (AgNO.)	(100 oz.) per oz.	..	.38½
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.22½	..
In barrels	Per 100 lb.	1.55-1.57½	2.40
In bags	Per 100 lb.	1.37½-1.40	..
Spot orders.. .025 per 100 lbs. higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07	.07½
Sodium hydrate (NaOH) (caustic soda) Solid	Per 100 lb.	2.90	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04½
95 per cent.	Per 100 lb.	2.25½	2.50
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.50
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	.39	.37½
Tin oxide (SnO_2) in bbls.	lb.	..	.54
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots	lb.	..	1.50-2.25
Zinc oxide (ZnO)	lb.	.08½	.12
American process, Bags	lb.	.06½	.07
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude, Gran. (Milled .005-.02c higher)		.03½	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to February 25, 1929

	January 1928 Quantity	January 1928 Value	January 1929 Quantity	January 1929 Value	Six Months Ending December 1928 Quantity	Six Months Ending December 1928 Value	Six Months Ending December 1929 Quantity	Six Months Ending December 1929 Value
Glass and glass products (total)	.....	716,533	.....	881,381	.....	4,453,106	.....	5,336,230
Plate and window glass—								
Window glass, common, box 50 sq .ft.	796	5,833	1,035	6,168	10,846	54,792	9,535	51,052
Plate glass, unsilvered, sq. ft.	92,327	34,934	207,559	74,116	574,035	186,788	1,164,835	341,119
Other window and plate glass lbs.	208,151	32,933	324,311	37,150	2,014,748	203,329	2,273,908	248,501
Glass containers (bottles, vials and jars)	.....	255,814	.....	278,840	.....	1,568,255	.....	1,809,550
Table glassware, plain	.....	97,363	.....	106,427	.....	691,767	.....	733,697
Table and other glassware, cut or engraved	.....	9,874	.....	7,920	.....	73,469	.....	79,341
Lamp chimneys and lantern globes lbs.	189,146	34,401	137,152	29,189	817,938	168,468	633,014	137,987
Globes and shades for lighting fixtures lbs.	117,856	41,205	189,448	59,048	814,568	297,495	1,003,702	341,301
Chemical glassware lbs.	15,665	15,779	18,200	18,718	125,261	108,024	129,711	111,895
Electrical glassware, except for lighting lbs.	242,489	30,451	757,016	50,042	1,039,516	122,879	2,252,539	225,091
Other glassware	.....	157,946	.....	213,763	.....	977,840	.....	1,256,696

IMPORTS

Corrected to February 25, 1929

Glass and glass products	.....	929,683	.....	1,122,481	.....	8,769,559	.....	8,550,680
Cylinder, crown and sheet—								
Unpolished, not bent, obscured, beveled, etc.—								
Weighing less than 80 pounds per case dut. lb.	2,893,959	88,090	3,442,931	88,567	21,437,437	585,310	19,529,873	656,893
Weighing 80 pounds or over per case dut. lb.	2,176,334	110,997	3,241,566	120,543	14,437,690	645,551	12,753,524	571,568
Polished and bent, obscured, beveled, colored, etc., unpolished and polished, and all silvered dut.	.....	31,039	.....	47,902	.....	187,470	.....	303,692
Plate glass—								
Polished, unsilvered dut. sq. ft.	808,559	178,109	1,402,029	291,981	6,577,974	1,704,103	8,015,899	1,636,801
Other dut. sq. ft.	89,806	23,877	57,056	11,474	778,558	188,747	998,946	272,444
Bottles, vials, jars, demijohns and carboys, molded or pressed dut.	.....	21,602	.....	29,351	.....	94,365	.....	144,573
Table and kitchen utensils dut.	.....	11,867	.....	16,855	.....	142,144	.....	165,643
Glassware, cut or decorated dut.	.....	181,553	.....	220,342	.....	2,108,950	.....	1,709,137
Blown glassware, n. e. s.—								
Bottles, ornaments, gauge glasses and other n. e. s. dut.	.....	66,724	.....	66,922	.....	1,454,971	.....	1,420,169
Bulbs for electric lamps dut. No.	1,391,119	14,261	2,146,584	17,496	7,681,050	89,110	9,276,861	109,248
Chimneys, globes, shades, prisms and other illuminating glassware dut.	.....	61,810	.....	78,140	.....	538,285	.....	555,982
Articles and utensils for chemical, scientific, and experimental purposes dut.	.....	42,372	.....	40,974	.....	268,234	.....	281,626
Other glassware dut.	.....	97,382	.....	91,844	.....	762,319	.....	722,904